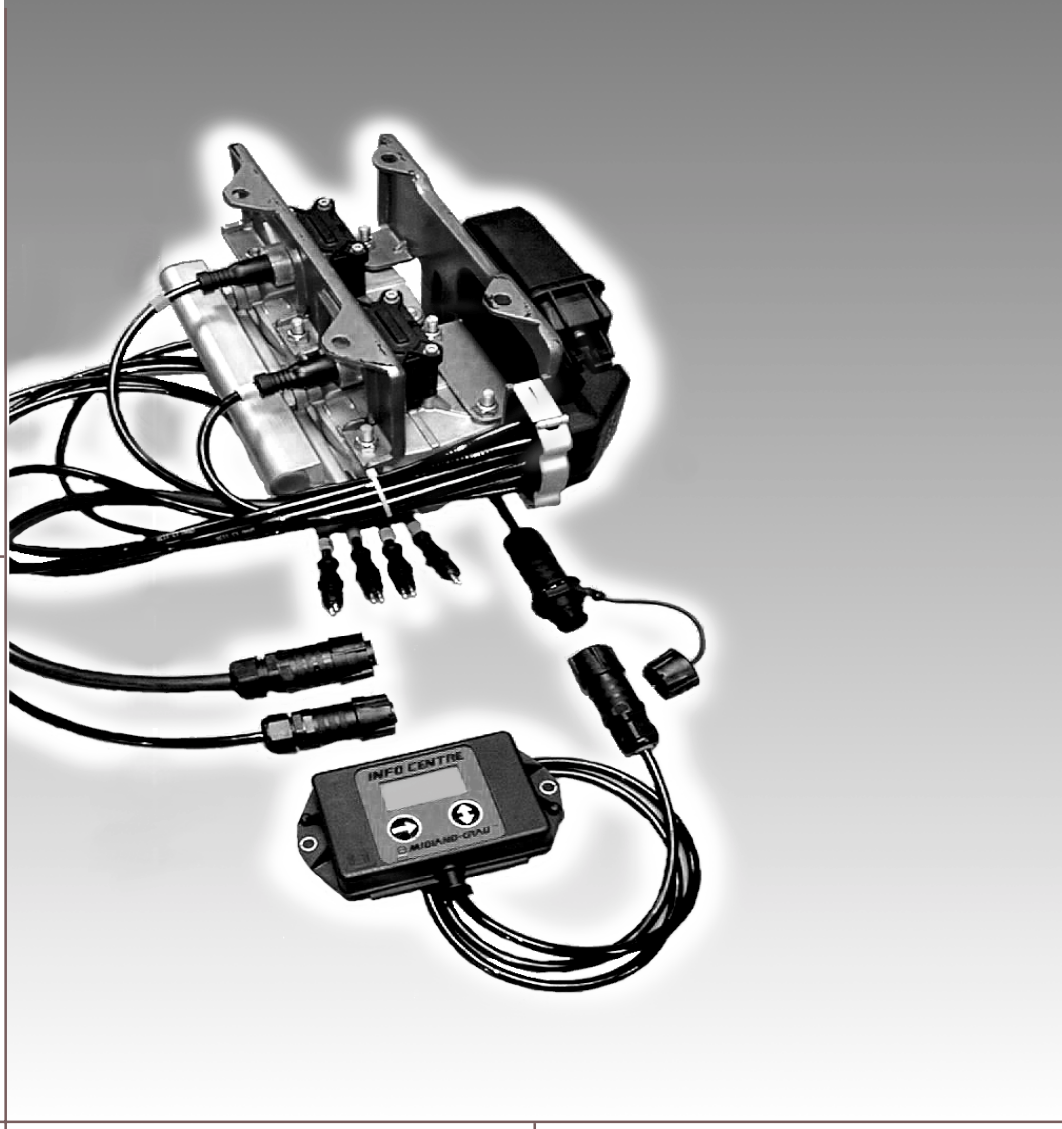

MODULAR ABS SERIES

MODULAR 1 UPGRADE
MODULAR 1 PLUS
MODULAR 2

SERVICE MANUAL

Haldex
Brake Systems

000700080

MODULAR

Haldex
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For ease of reference each section of this manual deals with an individual aspect or component part of the MODULAR trailer ABS system.

To access the particular information which you require, initially refer to the Main Section Index at the front of the manual and select the appropriate item(s) section.

Each section has its own index card at the front of the section, listing sub-sections, which deal with particular features of the component or procedure concerned.

Wherever necessary cross references are made within each sub-section which guide you to related information.

Sections are numbered in sequence, as are the sub-sections.

Where cross references are used, the first number refers to the appropriate section number, whilst the second number refers to the sub-section concerned. Example: In section 9.2 reference is made to section 7.4 which may be found in section 7.0 item 7.4.

In the case of figure numbers, once again each of the section figures is numbered in sequence within its own section. Hence, in order to avoid repetition, a particular figure which appears in one section may have relevance to another section to which it is cross referenced. i.e. In section 9.5 reference is made to figures 3.2 and 4.1 which will be found in sections 3.0 and 4.0 respectively annotated by the appropriate figure number.

MODULAR

Haldex
Brake Systems

AMENDMENT RECORD SHEET

From time to time it may be necessary for Haldex Brake Products Ltd to issue updates to this manual.

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AMENDMENT NUMBER	SECTIONS AFFECTED	DATE ENTERED
1		JUNE 1998
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1.0 INTRODUCTION

1.1 GLOSSARY OF TERMS

BU — Refers to BLUE, the required channel colour coding for modulators, and sensors.See also RD and YE.

CHANNEL — The electrical connection between the ECU and modulator. The number of ABS control channels is equal to the number of modulators fitted.

CONFIGURATION — The arrangement of ABS components for any given installation.

EOLT — Computer software package for 'End-of-line' testing of ABS system functions during trailer manufacture.

DDU — The hand held Diagnostic Display Unit.

ECU — The Electronic Control Unit of the anti-lock brake system.

EXCITER — A slotted or castellated steel ring fitted in the hub or brake assembly used in conjunction with the sensor to generate electrical information proportional to wheel speed.

INFO CENTRE — A device with a LCD display, trailer mounted, which may be used to recall information from the memory of the ECU.

INTEGRATED SYSTEM — A Modular ABS installation where the modulators and ECU are mounted in one unit on a common bracket, located over the centre of a bogie. (See Fig 1.6,1.7 and 1.8). Generally applicable to semi-trailers and centre axle trailers.

ISO 1185 — The 24N electrical connection to the trailer from which power for the ABS may be drawn from pin 4 using the stoplamp circuit.

ISO 3731 — The 24S electrical connection to the trailer from which power for the ABS may be drawn from pin 6 to provide a permanent power supply.

ISO 7638 — The electrical connection to the trailer which provides a dedicated ABS power supply.

LCD — Liquid Crystal Display relevant to the DDU display and Info Centre.

M — Refers to a modulator. i.e. the ABS air control valve.

MANIFOLD — The central device on which modulators of a two channel system may be commonly mounted, and pneumatically linked.

MODULAR ABS — The product name for one of a range of trailer Anti-lock Brake Systems produced by Haldex Brake Products Ltd.

MODULATOR(S) — The pneumatic control valve(s) of the anti-lock brake system.

NON-INTEGRATED — An ABS system in which the modulators are mounted remotely from the ECU assembly. Generally applicable to Full trailers.

RD — Refers to RED, the required channel colour coding for modulators, and sensors. See also BU and YE

S — Refers to a sensor.

SENSOR — A magnetic device mounted in the brake or hub assembly used in conjunction with the exciter to generate electrical information proportional to wheel speed.

S1A — A sensor position displayed on the DDU or Info Centre relative to the position of that sensor on the vehicle as shown in the configuration diagrams in section 8.0.

S2A A sensor position displayed on the DDU or Info Centre relative to the position of that sensor on the vehicle as shown in the configuration diagrams in section 8.0.

S3A A sensor position displayed on the DDU or Info Centre relative to the position of that sensor on the vehicle as shown in the configuration diagrams in section 8.0.

S1B A sensor position displayed on the DDU or Info Centre relative to the position of that sensor on the vehicle as shown in the configuration diagrams in section 8.0.

S2B A sensor position displayed on the DDU or Info Centre relative to the position of that sensor on the vehicle as shown in the configuration diagrams in section 8.0.

S3B A sensor position displayed on the DDU or Info Centre relative to the position of that sensor on the vehicle as shown in the configuration diagrams in section 8.0.

SPLIT FRICTION
A road surface condition where the tyres of wheels across the same axle experience different amounts of grip from one side of the vehicle to the other.

PC INTERFACE
Computer hardware providing a facility for linking a PC to the ABS ECU.

YE Refers to YELLOW, the required channel colour coding for modulators, and sensors. See also RD and BU.

VDS Computer software package for collecting data from the ABS ECU and storing to the PC.

2S1M Two sensors and one modulator (see configurations section 8.0).

2S2M Two sensors and two modulators (see configuration section 8.0).

4S2M Four sensors and two modulators (see configuration section 8.0).

1.2 DRIVER INFORMATION

MODULAR ABS is provided with a warning lamp to indicate the ABS status.
The GREEN lamp if fitted, will be mounted on the headboard of the trailer in the rear view mirror line of vision. When the ABS is electrically powered from the stop lamp circuit and no other source the lamp operates only when the brake pedal is pressed.
Under these circumstances when the vehicle is moving at 6 m.p.h. (10km/h) or more and the brakes are applied the green lamp should flash briefly and then stay off.
If the vehicle is stationary and the brake pedal is applied the green lamp should flash briefly, then come on and stay on.
NOTE: At speeds above 6 m.p.h. (10km/h) when the brakes are applied no lamp flash or a permanently lit lamp indicates a system fault which should be investigated.

A RED lamp will be fitted in the cab dashboard when the ABS is powered by a dedicated (ISO7638) or a supplementary (24S) power supply from the ignition switch.
When the ignition is turned on the red lamp should flash briefly and then come on until the vehicle speed exceeds 6 m.p.h. (10km/h) then the lamp should go out.
NOTE: For any single driving cycle, (ignition on to ignition off). If there is no lamp flash when the ignition is turned on, or if a permanently illuminated lamp occurs after the vehicle has exceeded 6 m.p.h. (10 km/h) at initial move off, a system fault is indicated which should be investigated.
If a red lamp (ABS2) is fitted in the cab this becomes the primary indicator and the trailer ABS will be permanently powered. In this case, the green trailer lamp will only function if :
(a) on initial power up, if the brake pedal is pressed before the ignition is switched on.
(b) during a fault event when the red lamp is illuminated and the brake pedal is pressed.
Further information on lamp sequences may be found in section 6.0.

1.3 BRAKING WITH ABS

In an emergency apply full force on the brake pedal. The ABS will be activated immediately you fully apply the brakes and will assist you to retain steering control of your vehicle according to the road surface conditions. DO NOT apply and release the brakes by pumping the brake. This is known as 'cadence braking' and can have a detrimental effect on vehicle braking

1.4 ABOUT MODULAR ABS

The Haldex MODULAR ABS system employs microcomputer technology to meet the high standards demanded by manufacturers and operators for modern trailer ABS.
MODULAR ABS conforms to all the requirements of current and future planned legislation for systems fitted to commercial trailers. The design embodies ease of installation and maintenance, with high performance specifications. MODULAR ABS prevents wheel lock during braking to maximise tyre grip and provide optimum deceleration and stability.

1.5 SYSTEM CONFIGURATION

MODULAR ABS may be fitted to trailers in different configurations as required by the manufacturer or operator.
The configurations conform to recognised standards for wheel sensing and control as explained in section 8.0.

1.6 WHEEL SPEED SENSING

MODULAR ABS employs exciters and sensors mounted in the brake assembly (see Figs 1.5) which provide an electrical output frequency proportional to the wheel speed. This signal is relayed to a microcomputer based Electronic Control Unit (ECU).
Section 2.0 details exciter information and section 3.0 sensor information.

1.7 CONTROL ELECTRONICS

The Electronic Control Unit (ECU) incorporates two microcomputers which process information from wheel speed sensors thereby calculating wheel acceleration and deceleration. When a wheel deceleration which would normally result in a locked wheel is detected the ECU energises the hold and dump solenoids in the modulator(s). The hold solenoid isolates the signal line to the modulator and prevents further pressure build up above the relay piston.
The dump solenoid releases air pressure from above the relay piston and thus from the brake chamber.
Rapid operation of the hold and dump solenoids adjusts the brake chamber pressure to the best possible condition to maximise tyre to road grip. Tyre to road grip will cause the wheel to recover from the developing lock condition. During recovery the wheel speed signal increases in frequency causing the ECU to de-energise the dump solenoid and switch the hold solenoid rapidly in a series of pulses which progressively re-applies the brakes. If the wheel then tends to lock the ABS action will be repeated.
In the event of a fault occurring the ABS will be switched off and a fault code stored in the ECU memory for repair reference.
Fault codes will be retained in memory even if power to the system is removed.
When the power supply to the ECU is restored the fault code can be displayed on an "Info Centre" (see Fig 9.1) or DDU (see Fig 3.2). Reference to the diagnosis guide in section 10.0, and the diagnostic code list in section 10.12 will enable rapid location and repair of the fault.

1.8 SYSTEM PNEUMATICS

ABS operation is provided by solenoid controlled pneumatic Stepping Relay Valves called modulators which may have 2, 3 or 6 delivery ports. The ABS configuration determines the type of modulator fitted. (See section 5.0 Modulators and section 8.0 Configurations).

1.9 SYSTEM WARNING LAMPS

The system may be provided with a warning lamp mounted on the trailer headboard visible to the driver in the rear view mirror.
The headboard lamp is green and may be duplicated by a red dashboard mounted warning lamp in the cab of the towing vehicle. In the case of cab mounted lamps reference should be made to the vehicle manufacturer's handbook. Further details may be found in section 6.0.

1.10 SYSTEM POWER SUPPLY

MODULAR ABS fitted to trailers may be powered from different sources depending on the supply which is available from the towing unit. See section 7.0, and wiring diagrams section 12.0

1.10 COMPONENT LOCATION

The location of MODULAR components will vary from one trailer type to another. Generally semi trailers are equipped with units in which the ECU and modulator(s) are mounted on a common bracket. This is referred to as an "integrated system" and is convenient where such an assembly is mounted over the centre of an axle, or axle group as in the case of semi-trailers and Centre Axle Trailers. This type of installation on a semi-trailer is shown in Fig 1.9.

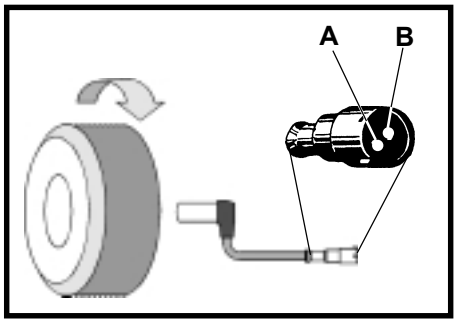
In the case of Full trailers, it is not possible to mount all the modulators in a single group at the rear of the trailer as this would adversely affect the ABS performance of the front axle due to the required long pipe runs. Consequently this system is not suitable for this type of trailer.

1.11 ROUTINE MAINTENANCE

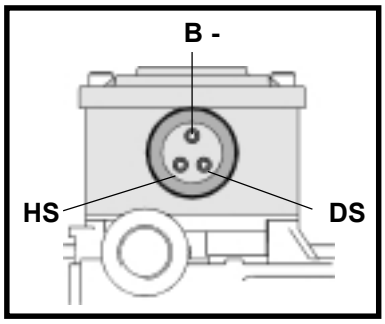
Information regarding routine maintenance of the MODULAR system and of associated braking systems is listed in section 13.0.

1.12 MULTIMETER READINGS

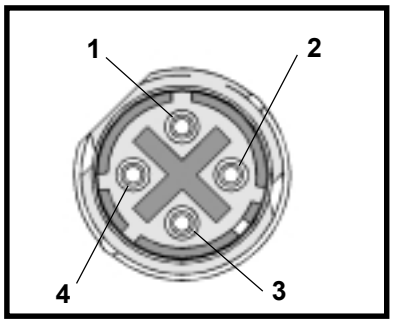
CHECKING POSITION	MEASURE BETWEEN	CORRECT VALUE	REMARKS	Fig
Sensor output	A B	0.2V AC Min.	Sensor 1A, 1B, 2A, 2B or 3A,3B Sensor disconnected from ECU. Wheel rotated at 1 rev/2 sec.	**1.1**
Sensor resistance	A B	>1.0 <2.4 kohm	Sensor 1A, 1B, 2A, 2B or 3A,3B Sensor disconnected from ECU.	**1.1**
Modulator Solenoid resistance	B - DS	>12 <20 ohm	Modulator cable disconnected . from solenoid.	**1.2**
Modulator Solenoid resistance	B - HS	>12 <20 ohm	Modulator cable disconnected . from solenoid.	**1.2**
Supply from ISO 7638	1 4	>18 <32V	Ignition on. Approx battery voltage	**1.3**
Supply from ISO 1185 (24N)	1 4	>18 <32V	Brake applied, Ignition on Approx battery voltage	**1.3**
Earth continuity	ECU/Modulator Bracket and Vehicle chassis	<5 ohms		
COLAS Solenoid resistance	+ -	>79 <96 ohms	Cable disconnected	**1.4**



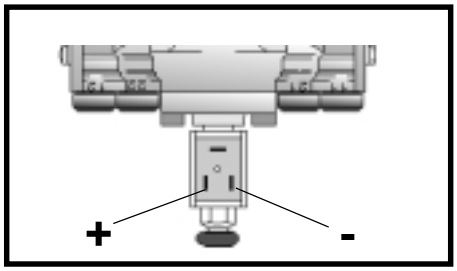
Sensor Connector - **Fig 1.1**



Solenoid Connector - **Fig 1.2**



Diagnostic Connector - **Fig 1.3**



COLAS Connector - **Fig 1.4**

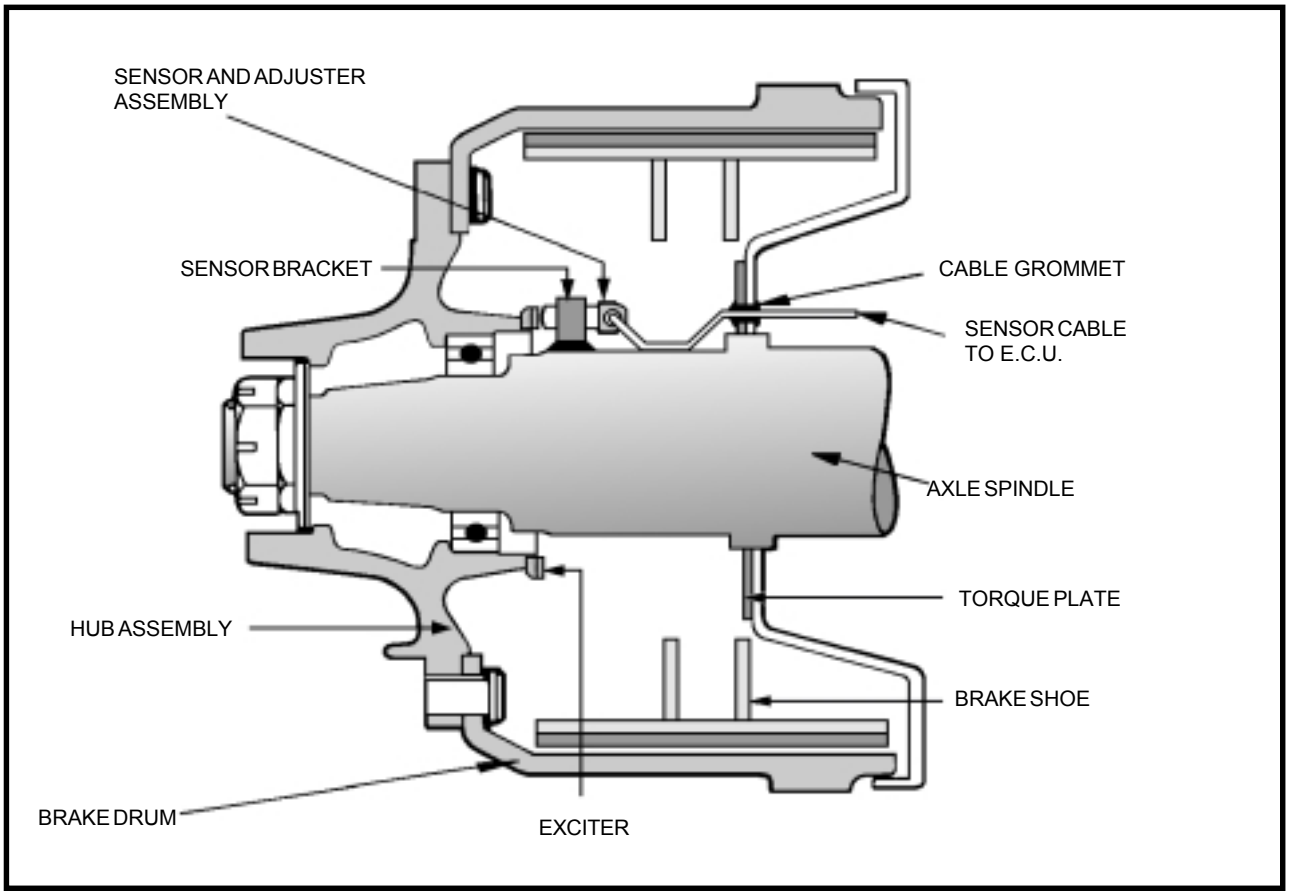


Fig 1.5 TYPICAL SENSOR AND EXCITER INSTALLATION

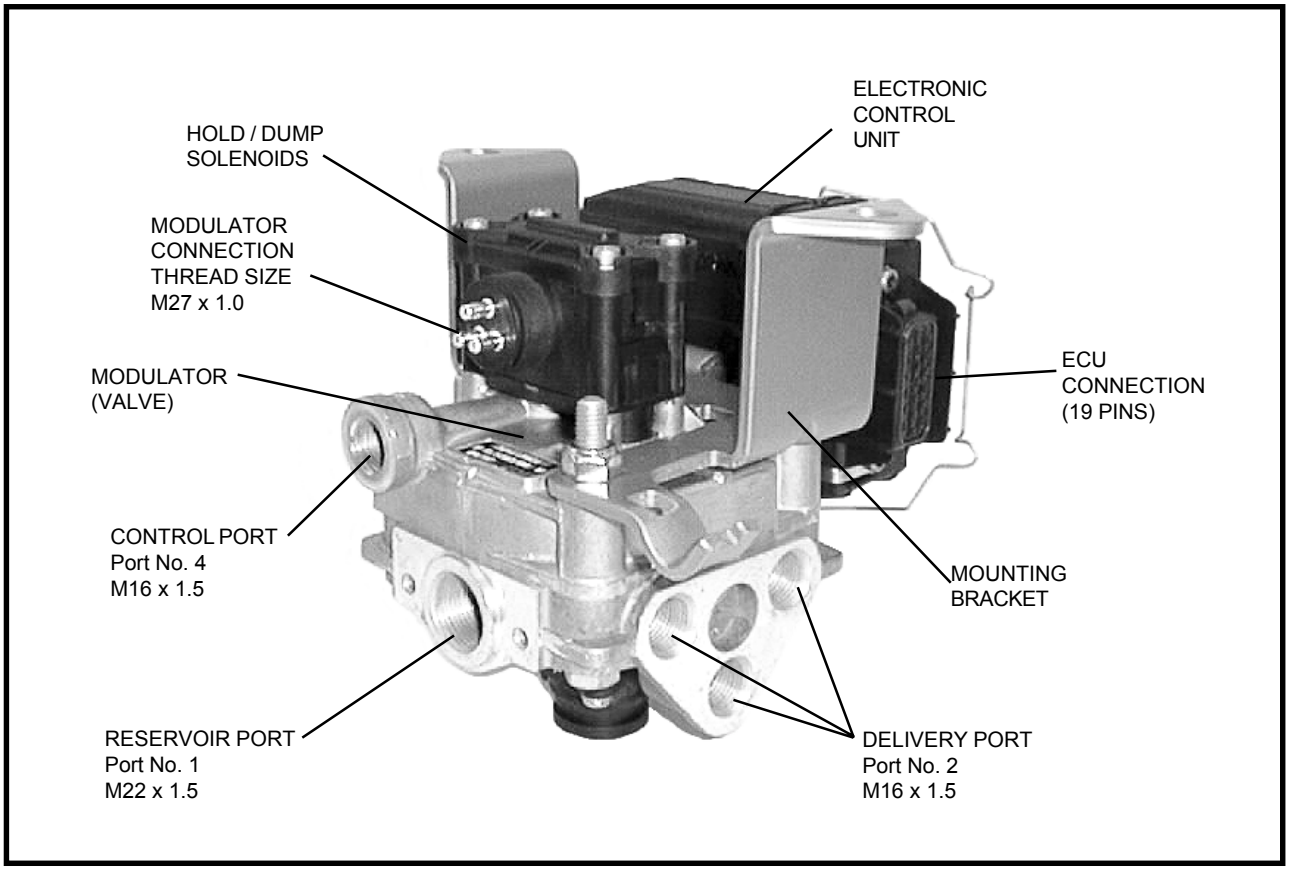

ELECTRONIC CONTROL UNIT
HOLD / DUMP SOLENOIDS
MODULATOR CONNECTION THREAD SIZE M27 x 1.0
MODULATOR (VALVE)
ECU CONNECTION (19 PINS)
CONTROL PORT Port No. 4 M16 x 1.5
MOUNTING BRACKET
RESERVOIR PORT Port No. 1 M22 x 1.5
DELIVERY PORT Port No. 2 M16 x 1.5

Fig 1.6 ECU AND MODULATOR ASSEMBLY - **MODULAR 1 UPGRADE**

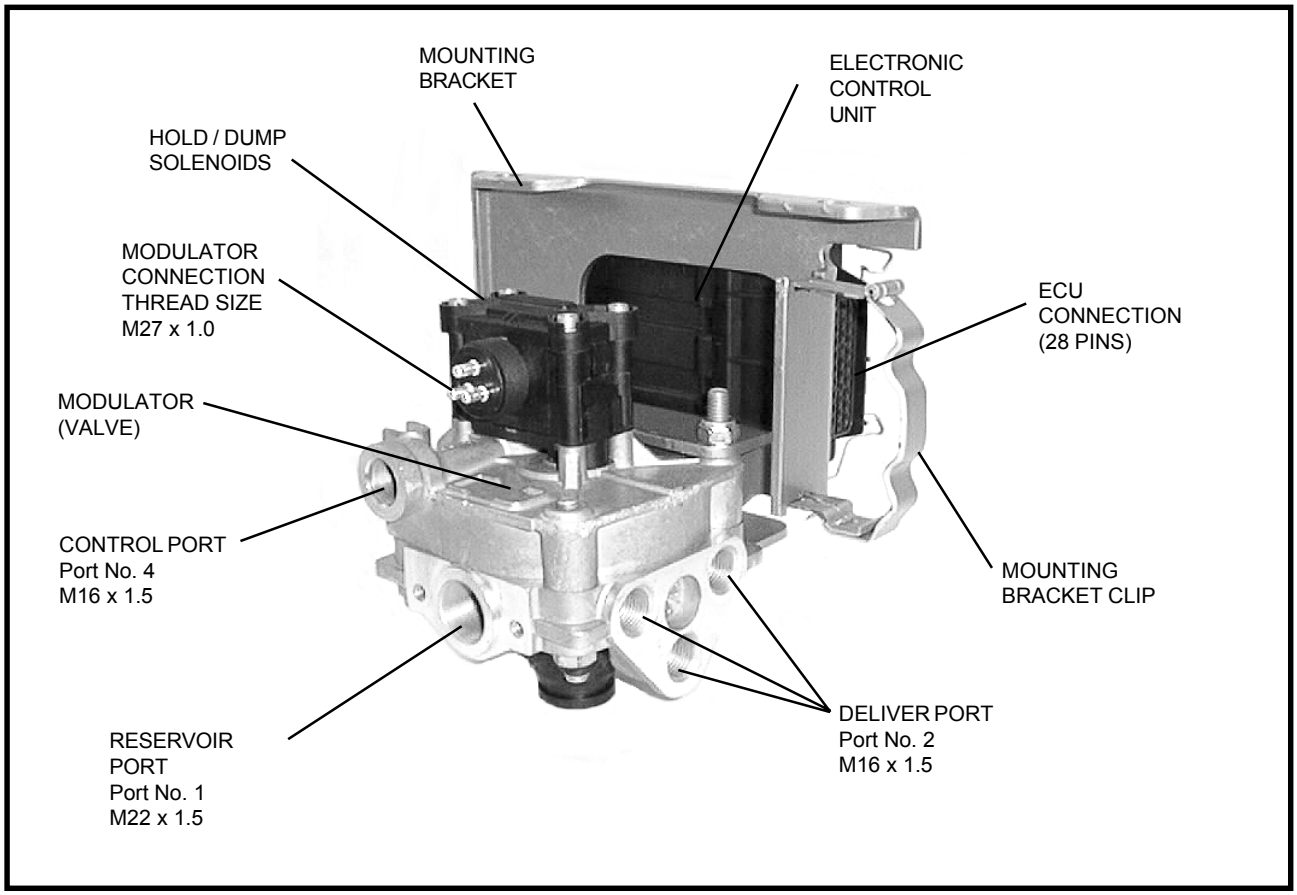

MOUNTING BRACKET
ELECTRONIC CONTROL UNIT
HOLD / DUMP SOLENOIDS
MODULATOR CONNECTION THREAD SIZE M27 x 1.0
ECU CONNECTION (28 PINS)
MODULATOR (VALVE)
CONTROL PORT Port No. 4 M16 x 1.5
MOUNTING BRACKET CLIP
DELIVER PORT Port No. 2 M16 x 1.5
RESERVOIR PORT Port No. 1 M22 x 1.5

Fig 1.7 ECU AND MODULATOR ASSEMBLY - **MODULAR 1 PLUS**

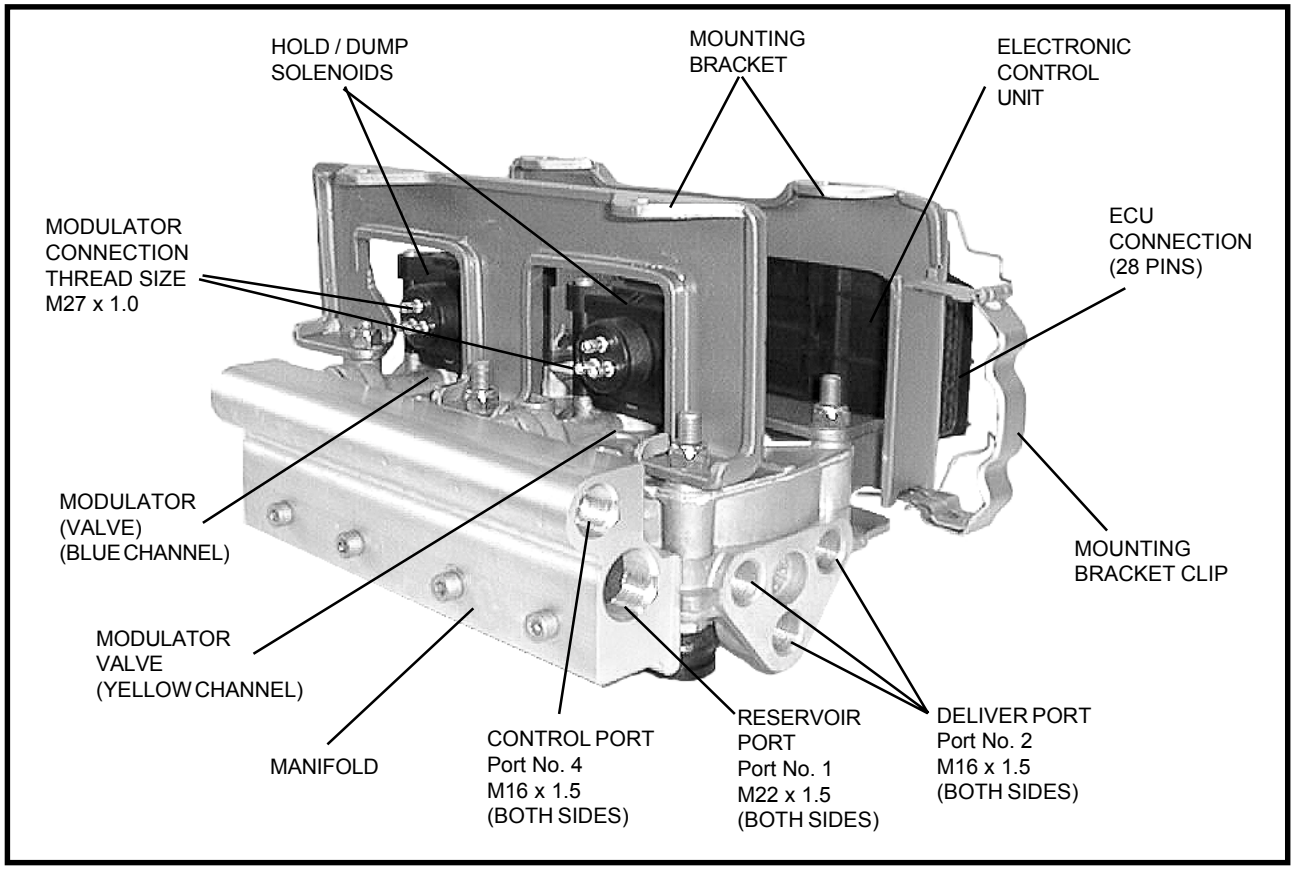
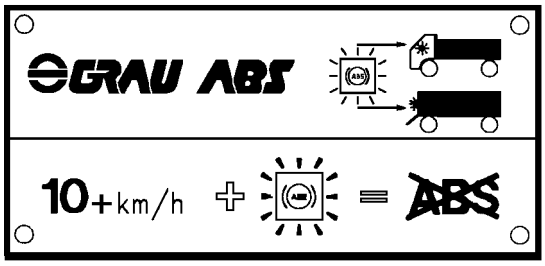

HOLD / DUMP SOLENOIDS
MOUNTING BRACKET
ELECTRONIC CONTROL UNIT
MODULATOR CONNECTION THREAD SIZE M27 x 1.0
ECU CONNECTION (28 PINS)
MODULATOR (VALVE) (BLUE CHANNEL)
MOUNTING BRACKET CLIP
MODULATOR VALVE (YELLOW CHANNEL)
MANIFOLD
CONTROL PORT Port No. 4 M16 x 1.5 (BOTH SIDES)
RESERVOIR PORT Port No. 1 M22 x 1.5 (BOTH SIDES)
DELIVER PORT Port No. 2 M16 x 1.5 (BOTH SIDES)

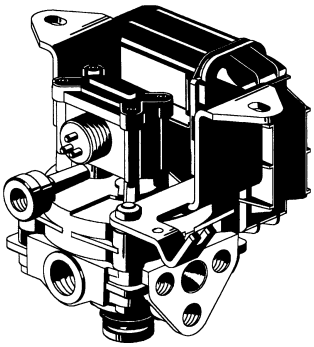
Fig 1.8 ECU AND MODULATOR ASSEMBLY - **MODULAR 2**

THE DRIVER INFORMATION PLATE

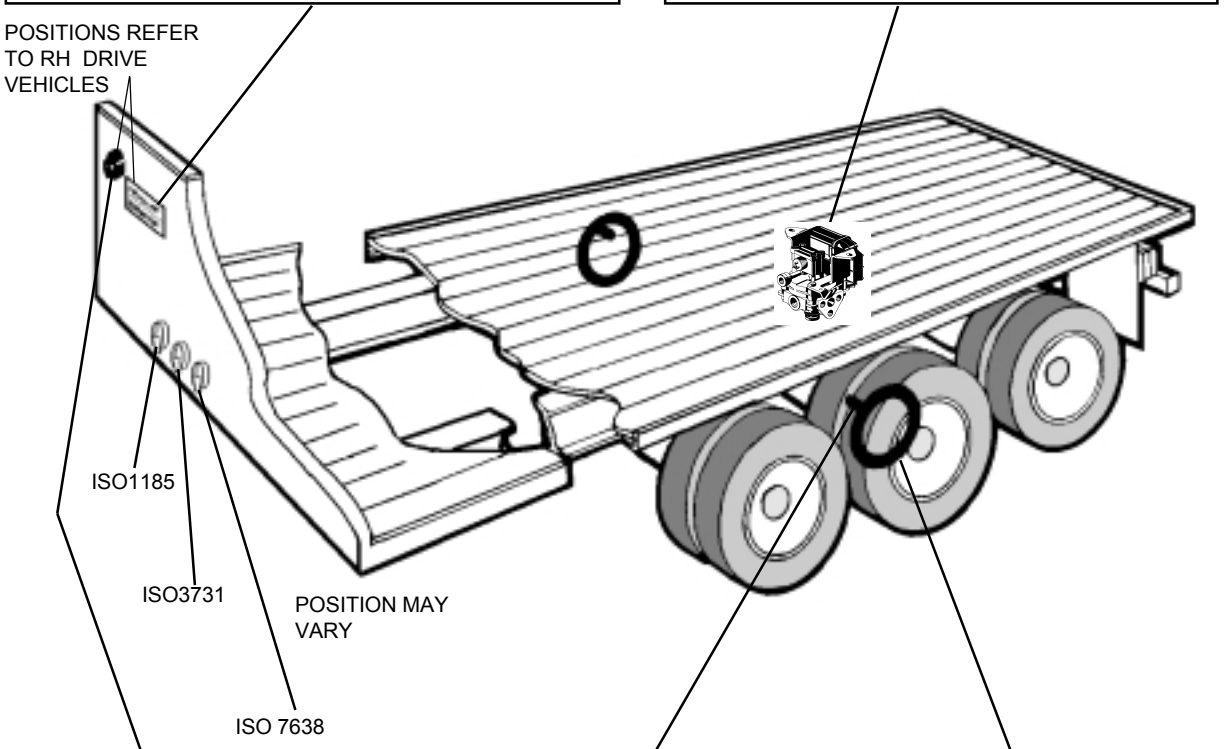


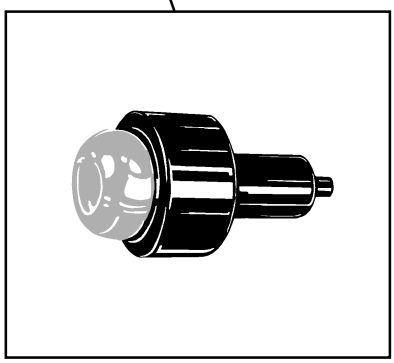
Translation: With Grau ABS on the tractor or trailer, at 10km/h or more, if ABS lamp is lit then ABS is shut down and will not work

ECU AND MODULATOR ASSEMBLY

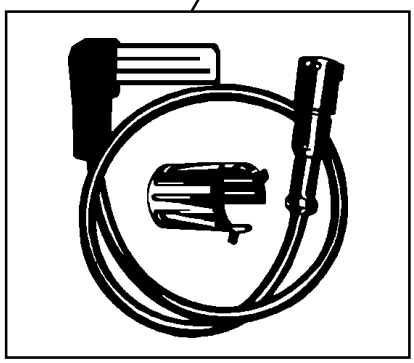


MODULAR 1 Upgrade shown for example

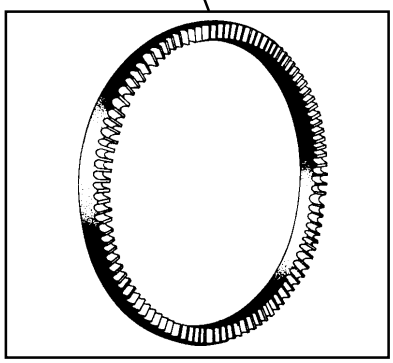




THE WARNING LAMP



THE SENSOR ASSEMBLY



THE EXCITER

Fig 1.9 COMPONENT LOCATION (2S1M SYSTEM SHOWN)

2.0 THE EXCITERS

The exciters will have 100 teeth or 80 teeth dependant on the wheel and hub size (see Fig 2.1). They are shrunk onto the nose of the hub, such that they are carried by the hub as it rotates with the wheel. (See Fig 2.2). In certain applications such as SAF axles the exciter may be internally toothed and interference fitted into the hub, outboard of the outer bearing. However the principles involved, and instructions in this manual still apply.

NOTE: THESE EXCITERS SHOULD ONLY BE USED ON SYSTEMS WHICH ARE KNOWN TO REQUIRE THE 100 OR 80 TOOTH TYPE. INCORRECT APPLICATION WILL CAUSE SYSTEM PERFORMANCE DEGRADATION.

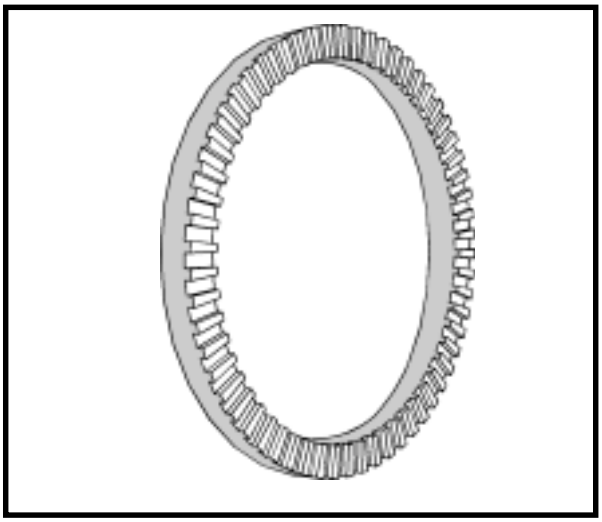


Fig 2.1. THE EXCITER (80 or 100 TEETH)

2.1 EXCITER MAINTENANCE

1. Generally the exciter requires no routine maintenance. However it should be cleaned and inspected for damage and checked for security on the hub spigot whenever the drum or hub is removed. Refer to axle manufacturer's instructions.

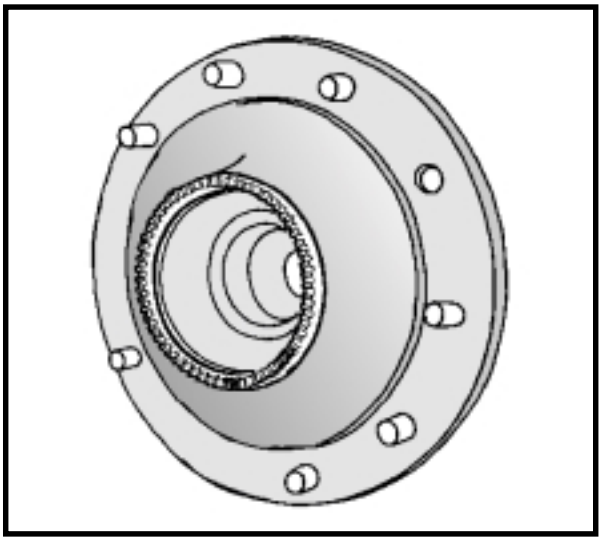


Fig 2.2. THE HUB AND EXCITER ASSEMBLY

2.2 EXCITER REPLACEMENT

In the event of an exciter being damaged it should be replaced with an identical unit observing the following procedure.

1. Remove the relevant hub from the stub axle.
2. Prise or drift the old unit off the hub assembly or alternatively drill and split it.
CAUTION: During this operation observe personal safety precautions and take care not to damage the hub assembly .
3. Clean the spigot and abutment face of the hub ensuring that they are free from burrs.
4. Replace the exciter by heating it evenly to a minimum temperature of 120 degrees Celsius. This may be achieved by using a hotplate or oven which is thermostatically controlled. (see Fig 2.3)
5. Whilst the exciter ring is hot place it over the hub nose ensuring that it seats correctly onto the location spigot machined on the hub.
6. When the exciter is correctly fitted there should be either a zero or equal gap between the shoulder of the machined hub and the back of the exciter throughout 360 degrees of rotation (see Fig 2.4).

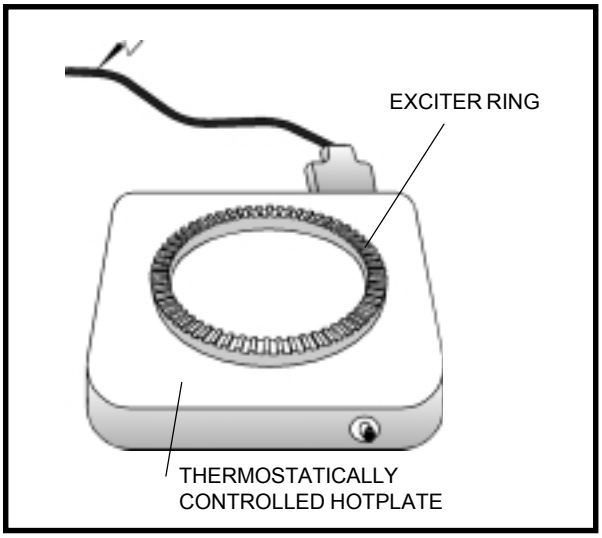


Fig 2.3. HEATING THE EXCITER RING

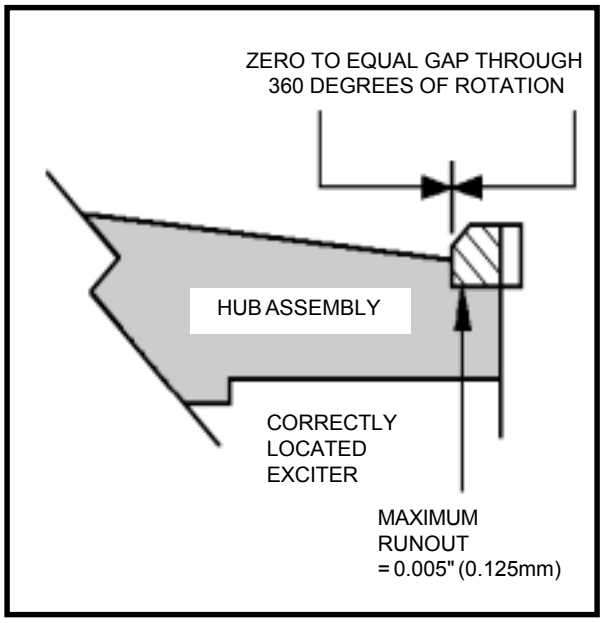


Fig 2.4. FITTING THE EXCITER TO THE HUB

2.3 FITTING THE HUB

1. Check the condition of the existing sensor before re-fitting the hub and exciter assembly to the stub axle.

2. The sensor should be wiped clean, and then reset as detailed in sections 3.1 and 3.4.

3. The hub assembly with its new exciter may now be fitted together with its bearings, to the stub axle.

4. During the re-assembly process avoid rocking the hub, and as soon as the hub centre nut can be engaged on its thread, use it to pull the assembly evenly onto the stub axle. This will ensure that as the exciter teeth make contact with the sensor, they will push the sensor back in its housing without damage to the exciter teeth, or the sensor. It also guarantees that an ideal running condition will be set up between the exciter and sensor, PROVIDED THAT THE SENSOR WAS CORRECTLY RESET BEFORE FITTING THE HUB.

5. If the sensor was not reset before assembling the hub to the stub axle, set the hub centre nut to the axle manufacturer's recommendations, then push the sensor through its housing until it contacts the exciter teeth.

6. Ensure that exciter teeth have not been damaged during refitment of the hub to the stub axle.

7. Rotate the hub several times to automatically set the ideal running condition.

8. The sensor output should now be checked as described in section 3.5.

3.0 THE SENSORS

The Modular sensor design incorporates a permanent magnet and coil which are environmentally sealed in a stainless steel housing. The coil is connected to a moulded flying lead which is terminated with a connector. The sensors are secured in their housings on the axle by a retaining clip which must always be fitted to ensure system integrity (see Fig 3.1) The sensor is bracket mounted in the axle assembly with its magnetic pole in close proximity to the exciter teeth, maximum 0.5mm (0.020"). The teeth pass through the magnetic field causing a change in magnetic flux density which in turn generates an alternating voltage in the sensor coil. The
frequency of the voltage generated is directly proportional to wheel speed. It is this signal which is monitored by the ECU to determine changes in wheel speed.

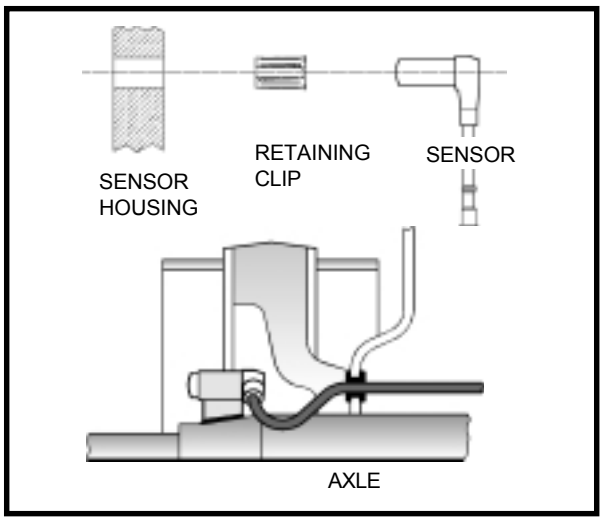


Fig 3.1 THE SENSOR ASSEMBLY

3.1 SENSOR MAINTENANCE

1. The sensor requires no routine maintenance but should be cleaned and inspected for damage, wear and security prior to resetting whenever the brake drums are removed.
Note: If sensor is removed from its housing lightly grease the sensor with a lithium based grease before installing back into the housing.

3.2 SENSOR WEAR CHECK

1. Remove the vehicle hub or the sensor from its mounting and clean the end face of the sensor.
2. If the sensor casing is holed or damaged it should be replaced. (See section 3.3 for instructions on replacement).
3. If the sensor is serviceable refer to section 3.4. for adjustment.

3.3 SENSOR ASSEMBLY REPLACEMENT

1. The design of Modular sensors enable them to be easily replaced if damaged. But before any work is commenced ensure that all electrical power is removed from the ECU.
2. When replacing a sensor always replace the retaining clip, and ensure that the electrical connections are clean, dry and correctly assembled, the sensor should be disconnected at the plug on its flying extension lead.
3. Remove the sensor from its housing together with the retaining clip. The housing is not usually replaced, unless it is damaged, however, a new retaining clip should always be fitted with a new sensor.
4. Clean the housing, removing any swarf or dirt.
5. Lightly grease the retaining clip with a lithium based grease, and press it fully home into the housing.
6. The sensor may be greased prior to assembly and then pressed firmly into the retaining clip until the sensor cable exit shoulder abuts against the inboard face of the housing, ensure the cable is not under tension or fouling the brake shoes or return springs (see Fig 3.1).
7. Ensure that the sensor cable run is routed as in the original installation and secure it with cable ties every 150mm.
Note: Do not overtighten the cable ties, as the brake hose will expand when the brakes are applied, and the cable ties may shear the inner conductor of the sensor cable.

3.4 SENSOR ADJUSTMENT (Resetting)

1. To set the sensor correctly follow the steps in sensor assembly replacement, then refit the hub assembly using the hub retaining nut to pull it into place on the stub axle.
DO NOT ROCK THE HUB ASSEMBLY ONCE THE EXCITER HAS CONTACTED THE NOSE OF THE SENSOR AS THIS WILL CAUSE THE SENSOR TO BE PUSHED TOO FAR BACK IN ITS HOUSING.
2. Provided that the hub is drawn smoothly onto the stub axle the sensor to exciter air gap will be automatically set to the correct running clearance as the components come into contact.
3. Setting the hub centre nut correctly to the axle manufacturer's data will ensure sufficient output. However it should be noted that the running clearance between the sensor and exciter must never exceed 0.5mm (0.020") at any point during one complete revolution.
4. Carry out a sensor output check as detailed in section 3.5.
5. Refit the brake drum and road wheels and

carry out the driver's checks described in section 1.2. to ensure that the correct lamp sequence is obtained but bear in mind the **Important Note** referred to in section 6.5

3.5 CHECKING THE SENSOR OUTPUT

1. Before commencing sensor checks ensure that the appropriate sensed wheels are jacked clear of the ground and suitably propped (observing all normal safety precautions) so that the wheels are free to be rotated by hand with no brake drag evident.
2. If necessary back off the brake adjustment temporarily for this test, after which the brakes should be readjusted to the manufacturer's recommendations.
3. Sensor outputs may be checked by using a Diagnostic Display Unit (DDU) plugged into the ECU diagnostic which will be mounted on the side of the trailer.
4. A suitable Multimeter as recommended in section 14.5, the use of which is described in section 3.5.C.

3.5.A USING THE DDU

1. Connect the DDU to its harness then locate the diagnostic outlet socket mounted on the side of the trailer marked "ABS TEST" and plug in the DDU harness.
2. With the Modular system powered up rotate the wheel of the sensor to be checked at a speed of one revolution every two seconds (30 RPM) and observe the DDU sensor indicator bar appropriate to the wheel being rotated. (See Fig 3.2)
3. If a solid bar appears in the DDU display window then the sensor output is satisfactory.
4. If the displayed bar flashes then the sensor requires resetting.

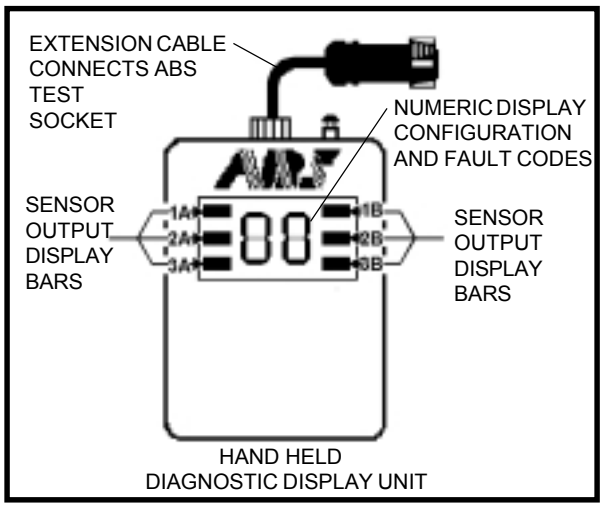


Fig 3.2 THE DDU DISPLAY

5. If there is no bar displayed then the sensor requires either resetting (see section 3.4) or it is damaged in which case it requires replacement. However before replacing the unit check the sensor resistance and continuity of its extension cable to determine whether the fault lies in the cable or the sensor. (See sections 3.7 and 3.8).

3.5.B USING THE INFO CENTRE

(Refer to relevant information in section 15.0).
1. Unclip cover from Info Centre and apply vehicle power.
2. The display will switch on showing all segments followed by the total distance reading.
3. Press button: Diagnostic code will be displayed
4. Press button: Wheel speed sensor check command will be displayed - WHL
5. Rotate one wheel only at 1 rev/2sec (30 RPM) . for a minimum of 4 seconds
6. Stop the wheel from rotating.
7. Observe the display -
wheel 1A gives S1A
8. Repeat procedure by rotating second sensed wheel.
wheel 1B gives S1B
9. If the display appears as above then the sensor output is satisfactory. If there is no display the sensor requires resetting or is damaged. Check as in section 3.5.A. point 5.

3.5.C USING A MULTIMETER

NOTE: The meter should be set to AC Volts on a scale range suitable for measuring low values. i.e. 300 millivolt scale.
1. Disconnect the sensor at its extension lead terminals.
2. Connect a suitable multimeter to the sensor leads (see section 14.5 Service Information for recommended types) .
3. Rotate the sensed wheel at a rate 1 rev/2sec (30 RPM) and note the output on the meter.
4. Output should be not less than 0.3 Volts A.C. with not more than 0.15 Volts A.C. variation during one complete wheel revolution.
5. Excessive variation of the sensor output indicates an exciter that is damaged, or that has been incorrectly fitted.
6. If the output is less than 0.3 Volts A.C. the sensor may require resetting (see section 3.4) or if damaged, replacement with a new component. (See section 3.3)
Before replacing a sensor check its resistance, and the continuity of its extension cable to

determine whether the fault lies in the sensor or its cable. (See section 3.7 and 3.8).

3.6 ADDITIONAL SENSOR CHECKS
If sensor outputs are found to be unsatisfactory proceed as follows:

FLASHING DISPLAY on DDU or LOW METER READING.
1. Reset the sensor as detailed in section 3.4 and check that the exciter is not damaged and is running true (see section 2.1, 2.2 and Fig 2.4).
2. Check the running clearance between exciter and sensor, which should not exceed 0.5 mm (0.020") at any point during one complete revolution.
3. Check the exciter face for dents or other damage

NO BAR DISPLAY on DDU / INFO CENTRE or NO METER READING.
The sensor is so far out of adjustment or damaged as to not give an output, reset as detailed in section 3.4. The sensor or its extension cable is open circuit, or extension cable connections have an
excessively high resistance. Proceed as follows: (section 3.7 and 3.8)

3.7 CABLE CONTINUITY
1. Unplug the sensor extension cable from the sensor flying lead at the back of the brake dust cover.
2. Bridge the pins of the extension lead plug at the end of the cable using a suitable jump wire.
3. Disconnect the harness at the ECU and carry out a continuity check of the cable as follows.
4. To test sensors connect the multimeter across contact pins in the main loom connector as detailed in section 4.0, Fig 4.6, 4.7 and 4.8.
The meter should show a full scale deflection.
5. If no continuity reading is obtained replace the extension cable as detailed in section 3.9. If however continuity is satisfactory then check the sensor resistance.

3.8 SENSOR RESISTANCE
Carry out a sensor resistance check as follows:
1. Unplug the sensor extension cable from the sensor flying lead at the back of the brake dust cover.
2. Insert the multimeter probes into the sensor connector socket and note the resistance, which should fall in the range **980 ohms to 2.35 kohms**.
3. If the result is outside the specified limits then replace the sensor as detailed in section 3.3.
4. If however the resistance is satisfactory then the sensor extension cable is at fault and should be replaced as detailed in section 3.9.

3.9 SENSOR EXTENSION CABLE REPLACEMENT
IMPORTANT NOTE: Cable replacement will involve cutting out and replacement of part of the ABS harness which is a one piece moulded unit. The connection is made by a window type in-line butt connector. The connectors are protected by heat shrink tubing containing a sealant. When heated the tubing shrinks and the sealant melts. A watertight joint is formed when the sealant solidifies on cooling. Heat should only be applied with a suitable hot air gun, such as Hellerman No. GHL 1550.

1. Disconnect sensor extension lead to be replaced, from the sensor and remove any retaining cable ties.
2. Cut the extension cable 200mm minimum from the ECU moulded connection or where the joint can be secured on a rigid area of the cable installation. Do not secure the joint on the hose or pipe going to the brake chamber.
3. Using wire strippers remove insulation on the ABS harness sensor ext.cable.(see Fig 3.3)

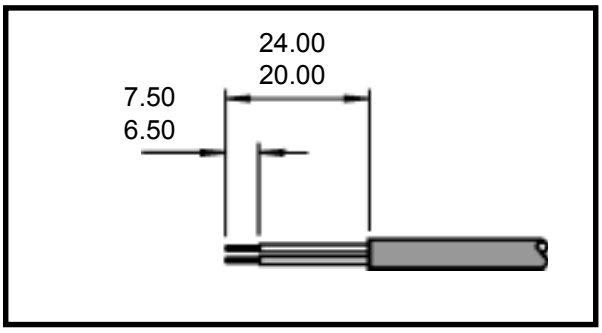


Fig 3.3 DETAILS OF INSULATION REMOVAL

4. Using a crimp tool (recommended is Thomas and Betts (Crimpex) ratchet No. WT2124Y) place terminal in the jaws and insert the wire until the insulation butts against the terminal barrel. Make the crimp, ensuring the connector has firmly gripped both the wire and insulation. Check by pulling the connector.
5. Feed the heatshrink tubing over the new sensor extension cable.
6. Join the extension cable onto the ABS harness via the two in-line crimps using tool as in point 4.

8. Secure the joint to a rigid area. (see Fig 3.4)

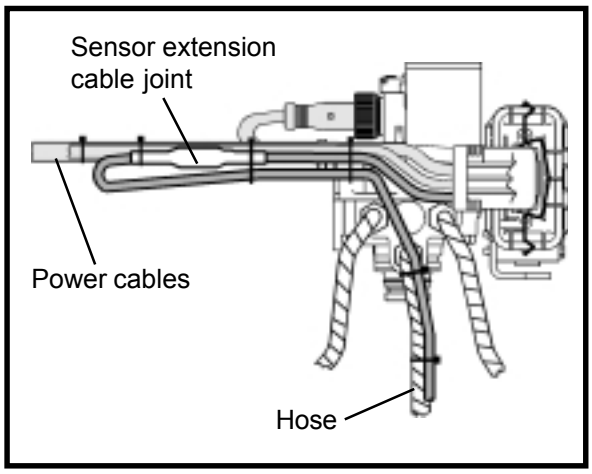


Fig 3.4 POSITION OF SENSOR JOINT

9. Route the wiring as in the original installation and connect as appropriate but note the following:
a) Fit cable ties to support the cables at 150mm intervals (do not overtighten) and refit any clips originally used.
b) When securing cables along rubber brake hoses, do not overtighten cable ties as this will damage the cable/hose when pressure is applied during brake application. It is always preferable to attach one cable tie to the hose and one to the cable and then loop the two together.
10. Carry out the driver's checks as described in section 1.2. (Driver information) but with regard to the **Important Note** in section 6.5.

4.0 THE ELECTRONIC CONTROL UNIT (ECU)

The ECU of the MODULAR ABS system is located on a mounting bracket in common with the modulator valve. (See Fig 1.2, 1.3 and 1.4). It has microcomputer controlled diagnostics detection circuits which log diagnostics to a memory that may be interrogated with a hand held diagnostic display unit (the DDU see Figs 3.2 and 4.10) or the Info Centre (see Fig 4.10).

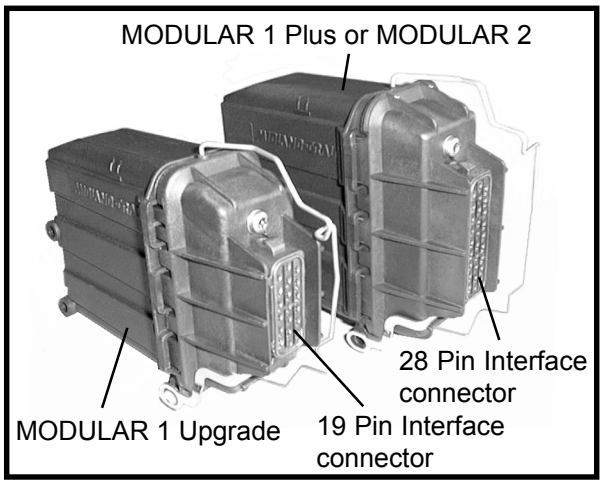


Fig 4.1 MODULAR SERIES ECU

The ABS ECU contains an AA size Lithium / Thionyl Chloride Battery that carries the following warning: **"Fire, Explosion and Severe Burn Hazard".** Under no circumstances should the battery be re-charged, crushed or tampered with in any way. The ECU should not be incinerated or stored above 100°C. The ABS ECU may be disposed of by landfill or re-cycled through a specialist operator, if in doubt consult your local authority for details or contact Haldex.

4.1 ECU FOR ADR REGULATIONS

To satisfy the ADR regulations for flammable loads (i.e. trailers built to FL, EX/III specification) a variant of a MODULAR 2 and its associated INFO CENTRE (see section 9.0) is available WITHOUT the powered odometer function.

Note: Hazardous load regulations do not permit the fitting of battery powered equipment (spark generators) to the rear of the firewall and so only this variant of MODULAR must be used.

All other functions are as standard MODULAR 2 ECU. For reference of the component part number refer to service parts in section 14.0.

This ECU must only be replaced by its exact equivalent on ADR vehicles.

4.2 DIAGNOSTICS

The ECU incorporates a diagnostic information output centre which provides information relevant to system configuration and diagnostic status. It is used for system diagnosis when a DDU or Info Centre is connected to the unit, at the ABS TEST diagnostic connector, enabling recovery of diagnostic codes.When connected the DDU or the Info Centre may also be used to test outputs from associated wheel sensors. (See section 3.5) Therefore it is possible to view the diagnostic code display from a remote position, such as alongside the vehicle or from the tractor unit cab when the vehicle is being driven.
NOTE: A DDU long extension lead (24m) is available which facilitates dynamic testing. For further information refer to section 10.4.
For further information on the Info centre refer to section 9.0 and relevant product information in section 15.0.

4.3 ELECTRICAL CONNECTIONS

The electrical connections to the ECU include power supplies, sensors, modulators and the diagnostic output. These connections are incorporated in a single ABS vehicle harness which has an integrally moulded connector, facilitating a single connection point for simplicity and system integrity.For further information refer to section 12.0 System Wiring.

4.3 ECU MAINTENANCE

The ECU requires no routine maintenance.

4.4 ECU REPLACEMENT

1. Locate the position on the trailer of the ECU and modulator valve assembly on their common mounting bracket.
2. Remove the ISO 7638, ISO 1185 (24N) and ISO 3731 (24S) connectors at the trailer coupling head so that there is no electrical power connected to the trailer.

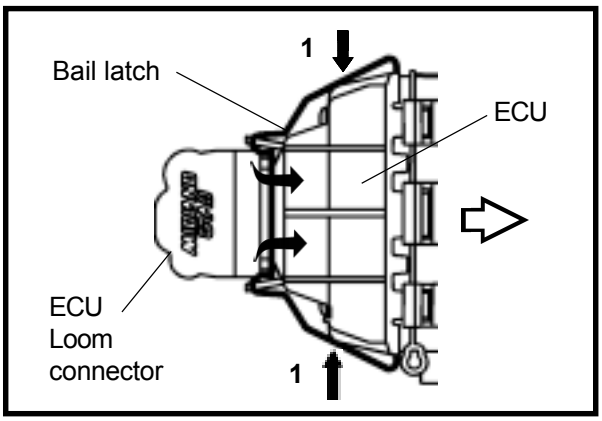


Fig 4.2 ECU BAIL LATCH REMOVAL

3. Press together the connector clips on the loom connector, see Fig. 4.3 and pull the ECU away from the connector housing.

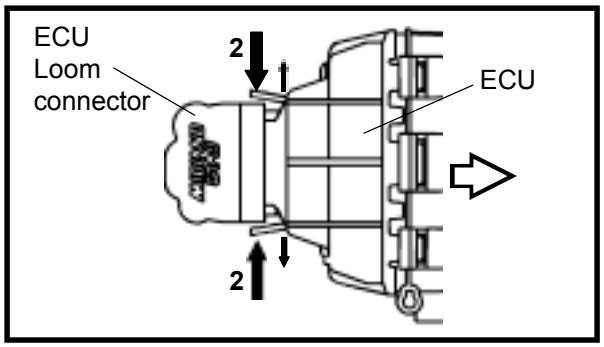


Fig 4.3 DISCONNECTION OF ECU

4. Remove the three retaining bolts securing the ECU using a 8mm ring spanner and remove it from the mounting bracket.
5. Fit **New** bail latch provided to new ECU by hooking bail latch ends into locating holes on ECU ensuring that the bail latch is the right way round to clip over the socket see Fig. 4.4.

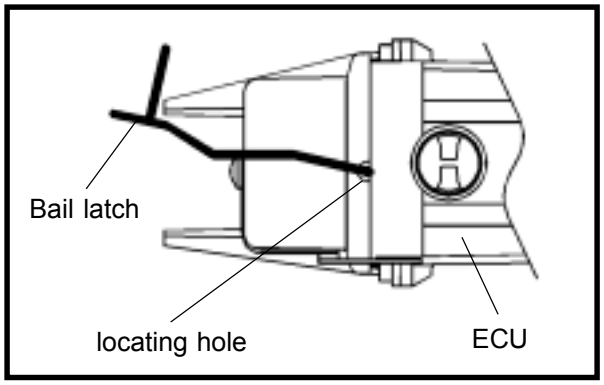


Fig 4.4 BAIL LATCH POSITIONING

6. Fit the new ECU in the reverse procedure to the above noting the following.
a: Clip the loom connector onto the ECU connector block ensuring that the **both** connector clips engage fully. see Fig. 4.5.
b: Tighten the retaining bolts to 1.7 - 2.8Nm.

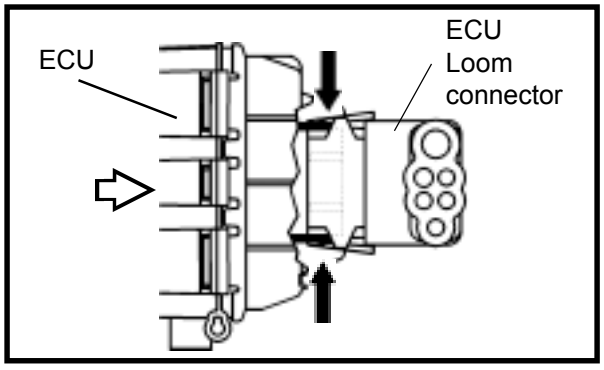


Fig 4.5 ENGAMENT OF ECU AND LOOM CONNECTOR

c: Ensure bail latch and loom clamp are fixed in position see Fig. 4.6.

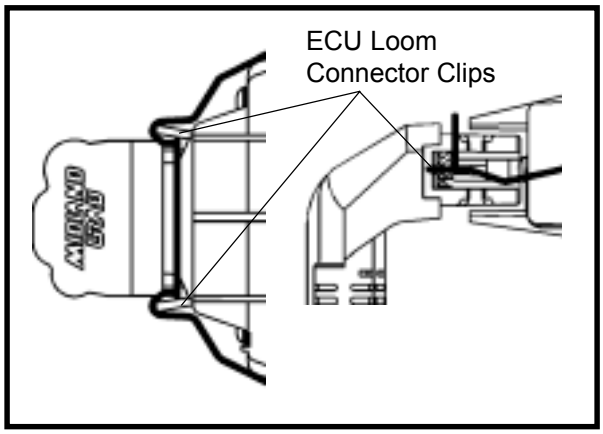
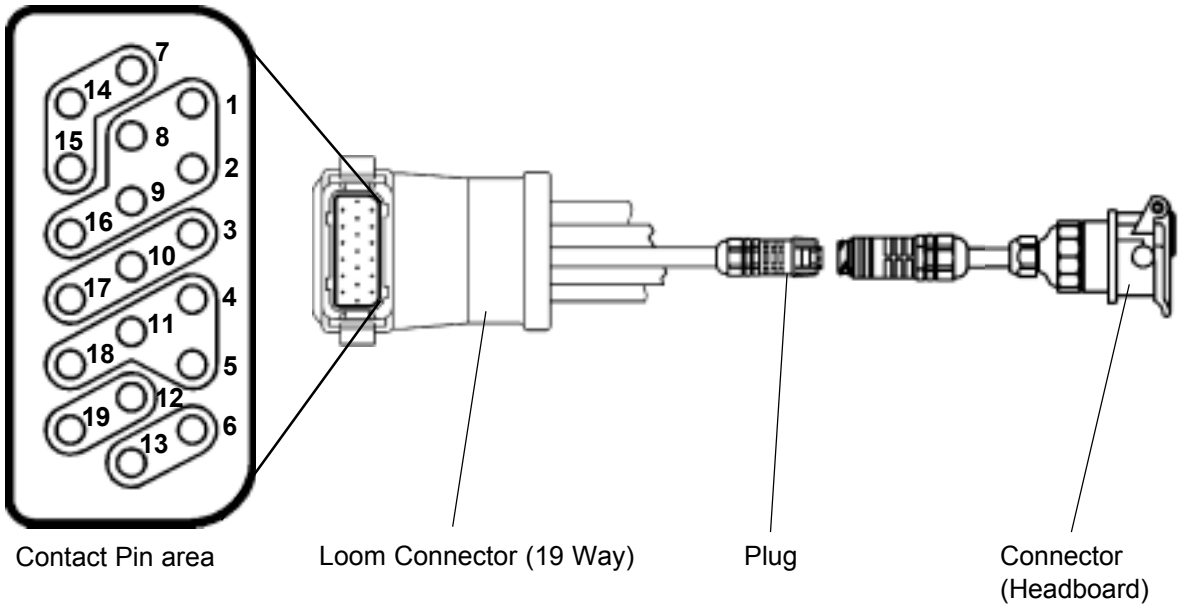


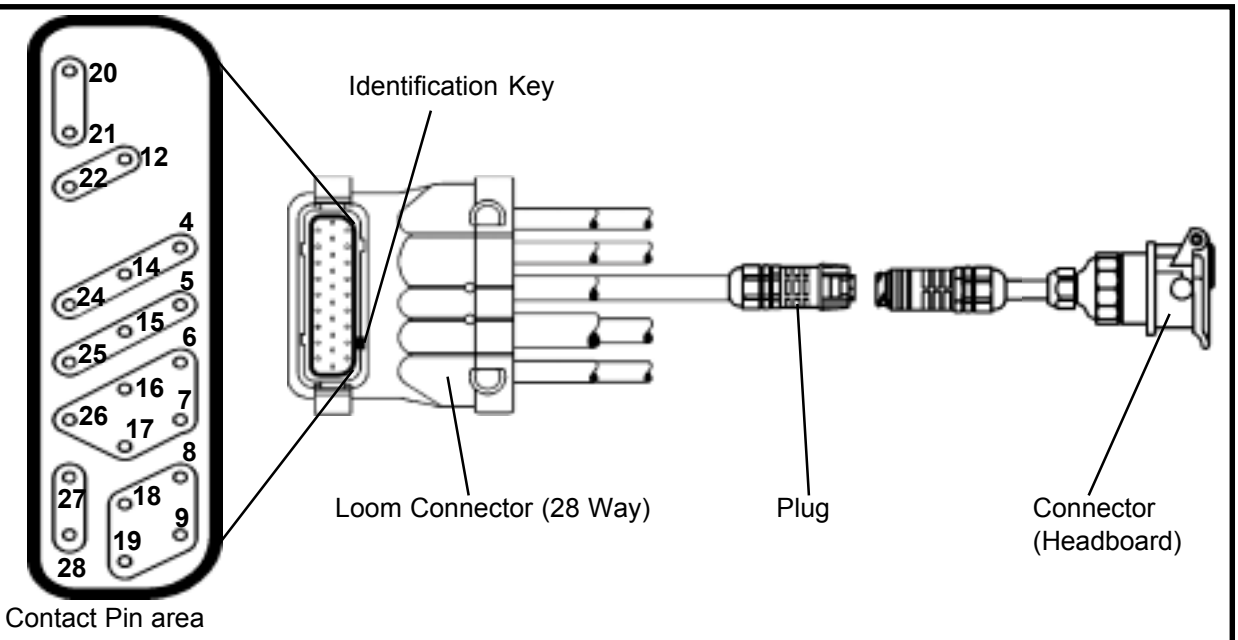
Fig 4.6 BAIL LATCH AND LOOM CLAMP POSITIONING

d: Check earth continuty - ECU/Modulator Bracket and Vehicle chassis to be **<5 ohms**.
7. On completion carry out the driver's checks described in section 1.2. (Driver's information) and in section 6.0.



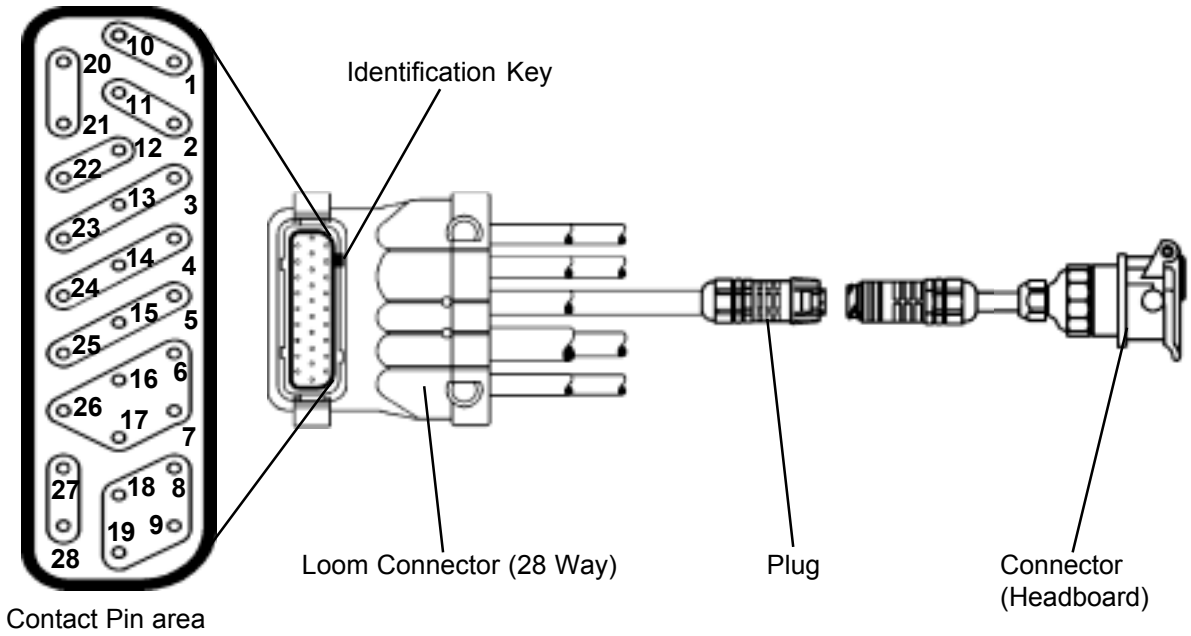
CONNECTION	CONNECTOR (19 Way) CONTACT PIN No.	PLUG PIN No.	CONNECTOR PIN No.	TERMINAL REFERENCE
ISO 7638	1	7 / RD	1	Battery positive permanent supply (B+P)
	2	6 / BK	2	Battery positive ignition switched (B+IGN)
	8	4 / YE	3	Battery negative (B-IGN)
	16	3 / W	4	Cab Lamp Return (B-)
	9	5 / BN	5	Battery negative permanent supply (B-P)
ISO 3731 (24S)	1		-	Battery positive permanent supply (B+P)
	2		6	Battery positive ignition switched (B+IGN)
	8		1	Battery negative (B-IGN)
	16		2	Cab Lamp Return (B-)
	9		-	Battery negative permanent supply (B-P)
ISO 1185 (24N)	17	2	1	Battery negative (B-)
	3	1	4	Battery positive (stoplamp) (B+)
	10	3	-	Trailer Lamp Return (B-)
MODULATOR SOLENOID	14		RD	Dump Solenoid
	15		BK	Battery negative (common) (B-)
	7		YE	Hold Solenoid
SENSOR 1A	6			Sensor Hi
	13			Sensor Lo
SENSOR 1B	12			Sensor Hi
	19			Sensor Lo
DIAGNOSTIC SOCKET	4	1		Battery positive (B+)
	11	2		ECU Output
	5	3		ECU Input
	18	4		Battery negative (B-)

Fig 4.7 **MODULAR 1 UPGRADE** MAIN LOOM CONNECTOR CONTACT PIN DETAIL



CONNECTION	CONNECTOR (28 Way) CONTACT PIN No.	PLUG PIN No.	CONNECTOR PIN No.	TERMINAL REFERENCE
ISO 7638	7	7 / RD	1	Battery positive permanent supply (B+P)
	6	6 / BK	2	Battery positive ignition switched (B+IGN)
	16	4 / YE	3	Battery negative (B-IGN)
	26	3 / BN	4	Battery negative permanent supply (B-P)
	17	5 / W	5	Cab Lamp Return
ISO 3731 (24S)	7	7 / RD	-	
	6	6 / BK	6	Battery positive ignition switched (B+IGN)
	16	4 / YE	1	Battery negative (B-IGN)
	26	3 / BN	-	
	17	5 / W	2	Cab Lamp Return
ISO 1185 (24N)	5	1	4	Battery positive (stoplamp) (B+)
	15	3	-	Trailer Lamp Return
	25	2	1	Battery negative (B-)
MODULATOR SOLENOID	4		RD	Dump Solenoid
	24		BK	Battery negative (common) (B-)
	14		YE	Hold Solenoid
SENSOR 1A	12			Sensor Hi
	22			Sensor Lo
SENSOR 1B	21			Sensor Hi
	20			Sensor Lo
DIAGNOSTIC SOCKET	9	1		Battery positive (B+)
	19	2		ECU Output
	8	3		ECU Input
	18	4		Battery negative (B-)
SUSPENSION CONTROLLER	27			Negative
	28			Positive

Fig 4.8 **MODULAR 1 PLUS** MAIN LOOM CONNECTOR CONTACT PIN DETAIL



CONNECTION	CONNECTOR (28 Way) CONTACT PIN No.	PLUG PIN No.	CONNECTOR PIN No.	TERMINAL REFERENCE
ISO 7638	7	7 / RD	1	Battery positive permanent supply (B+P)
	6	6 / BK	2	Battery positive ignition switched (B+IGN)
	16	4 / YE	3	Battery negative (B-IGN)
	26	3 / BN	4	Battery negative permanent supply (B-P)
	17	5 / W	5	Cab Lamp Return
ISO 3731 (24S)	7	7 / RD	-	
	6	6 / BK	6	Battery positive ignition switched (B+IGN)
	16	4 / YE	1	Battery negative (B-IGN)
	26	3 / BN	-	
	17	5 / W	2	Cab Lamp Return
ISO 1185 (24N)	5	1	4	Battery positive (stoplamp) (B+)
	15	3	-	Trailer Lamp Return
	25	2	1	Battery negative (B-)
MODULATOR	4		RD	Dump Solenoid
SOLENOID	24		BK	Battery negative (common) (B-)
(Yellow Channel)	14		YE	Hold Solenoid
MODULATOR	3		RD	Dump Solenoid
SOLENOID	23		BK	Battery negative (common) (B-)
(Blue Channel)	13		YE	Hold Solenoid
SENSOR 2A	1			Sensor Hi
	10			Sensor Lo
SENSOR 3A	12			Sensor Hi
	22			Sensor Lo
SENSOR 2B	2			Sensor Hi
	11			Sensor Lo
SENSOR 3B	20			Sensor Hi
	21			Sensor Lo
DDU SOCKET	9	1		Battery positive (B+)
	19	2		ECU Output
	8	3		ECU Input
	18	4		Battery negative (B-)
SUSPENSION	27			Negative
CONTROLLER	28			Positive

Fig 4.9 **MODULAR 2 (2S/2M and 4S/2M)** MAIN LOOM CONNECTOR CONTACT PIN DETAIL

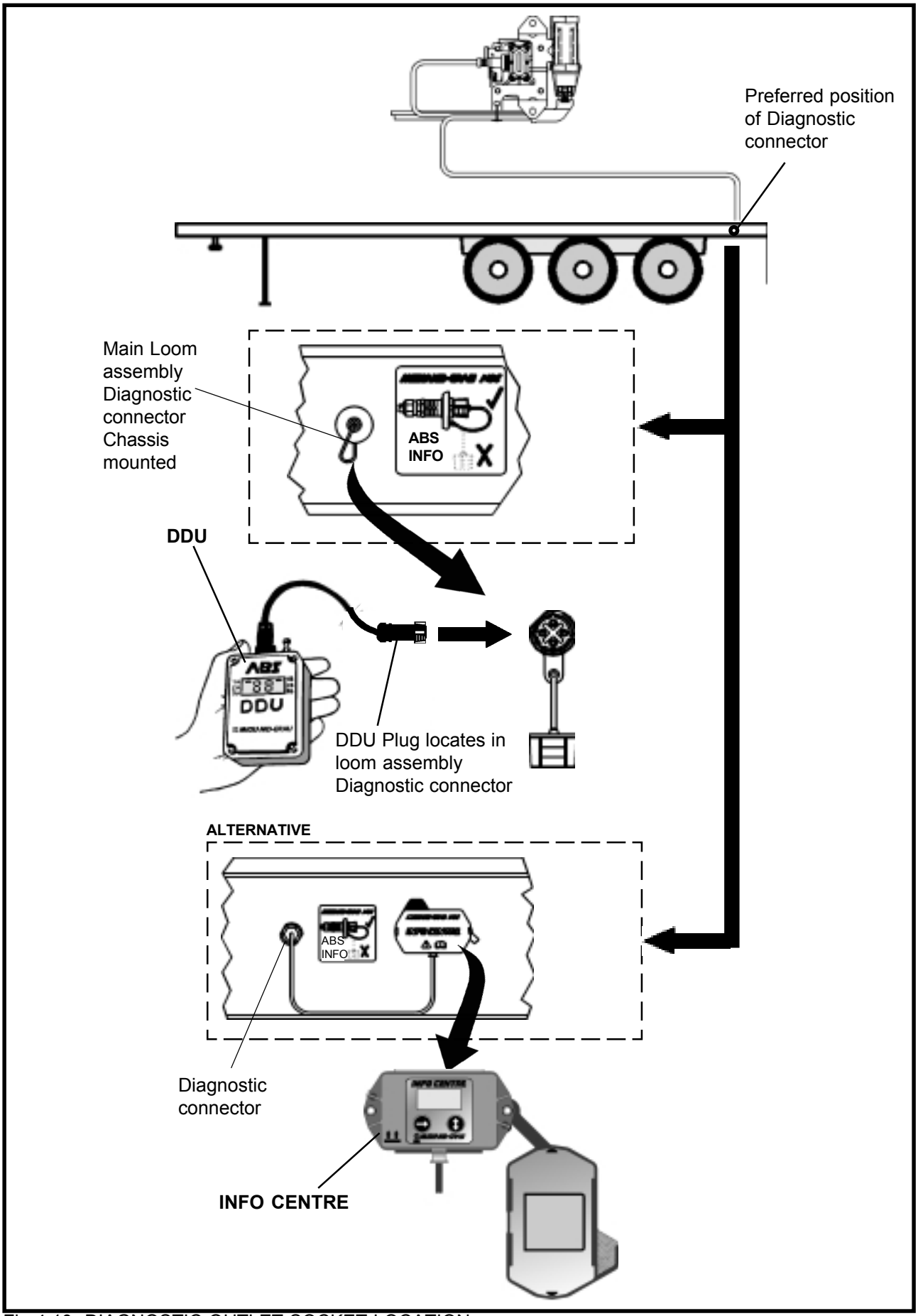


Fig 4.10 DIAGNOSTIC OUTLET SOCKET LOCATION

5.0 THE MODULATOR VALVE

The modulator comprises a relay type valve with a solenoid block containing hold and dump control solenoids mounted on the upper housing.

Modular 1 is designed as a 2S1M ABS system and therefore will have only a single channel, i.e. only one modulator valve electrically connected to the ECU.

Single channel systems on multi-axle trailers employ a single modulator which has six delivery ports, one for each brake chamber.

Exceptions do occur though , e.g. single axle trailers may have a single 2 port modulator in some cases.

Modular 2 is designed as a 2S2M or a 4S2M ABS system and therefore will have a two channel system, i.e. two modulator valves electrically connected to the ECU.

5.1 MODULATOR MAINTENANCE

The modulator valve requires no routine maintenance but should be periodically checked for security, function and air leaks.

It is not possible to service the modulator or solenoid block but, each of these items may be replaced independently of the other with a new guaranteed component.

Should either the hold or dump solenoids be suspected as faulty, they may be tested for the correct values of resistance which should lie in the range **12 to 20 ohms.**

IMPORTANT: It is vital that only genuine Haldex replacement parts are used as any other make may result in defective braking and/or ABS malfunction.

5.2 MODULATOR REPLACEMENT

The modulator is mounted on a bracket in common with the ECU, which is located beneath the trailer over or near the bogie centre line.
The electrical connection to the solenoid is achieved via a connector moulded to the cable and is retained in the solenoid block by an M27 threaded knurled gland nut which secures the cable connector to the valve.
This type may be removed from the solenoid block, whenever it is necessary to access the harness or ECU assembly.

Procedure :
1. Ensure that all electrical power sources are removed from the ABS.
2. Release all air pressure from the appropriate air reservoir.
3. Remove any cable ties securing the solenoid cable between the solenoid and the ECU.
4. Unscrew the gland nut which secures the solenoid electrical cable to its housing and disconnect it from the solenoid.
5. Disconnect the signal line from port 4 of the modulator valve.
6. Disconnect the reservoir supply from port 1 of the modulator valve.
7. Disconnect the brake pipes from the modulator delivery ports (numbered 2). It is important that pipe positions are noted and replaced in the same ports from which they were removed.
8. Remove the three nuts securing the modulator to the bracket and lower the modulator from its mountings.
NOTE: When releasing the modulator mounting nuts, avoid rotating the associated bolts which also serve to hold the valve body sections together.
9. Proceed to section 5.3 - If replacing solenoid only.

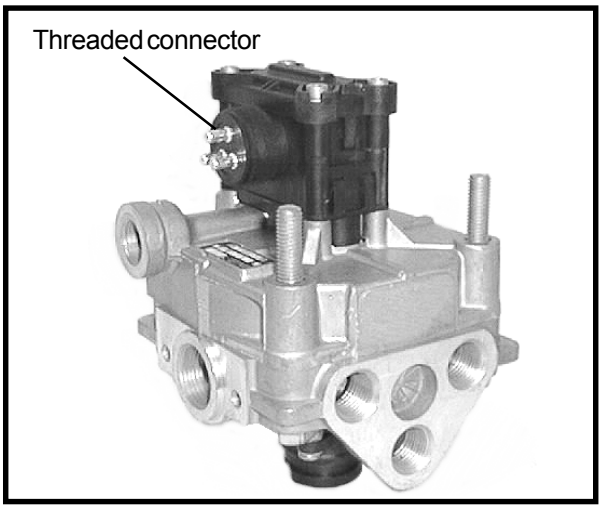


Fig 5.1 MODULATOR VALVE WITH M27 THREADED CABLE CONNECTOR

10. Reverse this procedure to refit the new unit. (See section 5.5).

5.3 FITTING THE MODULATOR ASSEMBLY
Refitting is the reversal of procedure 5.2 but noting the following points:

1. Mount the modulator in the same orientation as the original installation.
2. Always use new self locking nuts to secure the modulator to its bracket.
3. Always connect the brake pipes to the same ports (port 2) of the modulator as in the original installation.
4. DO NOT USE PTFE TAPE, as this tends to fragment and work its way into the modulator, resulting in malfunctions due to blockage or leakage.

5. Ensure correct location of the solenoid cable connector and hand tighten the gland nut taking care not to cross thread it.
6. Replace any cable ties as originally fitted, but do not over tighten them as this may damage the cable.
7. Reconnect the signal (port 4) and the reservoir (port 1) lines, and charge the air system.
8. Carry out an air leakage check as detailed below.
9. Carry out the Lamp sequence check as described in section 1.2 (driver information).

SPECIAL NOTE: When undertaking any pipework repairs where it is necessary to seal fittings, always use a high quality liquid sealant. Do not under any circumstances use PTFE tape or similar sealants as shreds of this sealant type may cause modulator malfunctions if they become embedded in the ball valve or solenoid areas.

5.4 AIR LEAKAGE CHECKS
After modulator or solenoid remedial work carry out a check for air leaks as follows:

Brake Unapplied Check
1. Fully charge the air system.
2. Without applying the footbrake listen at the modulator exhaust port (and manifold interfaces where appropriate) for audible air leakage. If audible leakage is noted investigation and remedial action is necessary.

NOTE: It is important that before a leaking modulator is replaced it is confirmed that the leak is within the unit itself and is not a leak from a pipe fitting or a back feed from a ruptured spring brake diaphragm.

To check a pipe fitting a water and soap solution or suitable leak detector spray may be applied and the area of suspected leakage inspected for bubbles.

Brake Applied Check
1. Fully charge the air system.
2. Apply the footbrake and listen at the modulator exhaust port for audible leakage. If audible leakage is noted investigation and remedial action is necessary.

5.5 SOLENOID OPERATION CHECK
1. Fully charge the air brake system.
2. Apply the footbrake and switch on the ignition listening for the exhaust of air from each modulator. There should be as many single brief pulses of air as there are modulators. (See section 8.0 configurations).

NOTE:
If there is no pulse then a fault exists which may be an open circuit solenoid, open circuit wiring or a fault at the ECU connector.

In the case of a double pulse, there is a wiring fault involving incorrect connection between the dump and hold solenoids.

3. If a single pulse does not occur repeat 1 and 2 with an assistant observing each of the modulators. Establishing which valve(s) are not producing pulses will provide a start to fault finding see section 10.0.
There should be no continuous audible leaks.
4. Finally carry out the Lamp sequence checks as detailed in section 1.2. (driver information).

6.0 MODULAR SYSTEM WARNING LAMPS

The various powering options referred to in section 7.0 will have a corresponding combination of warning lamps fitted to the vehicle. The towing vehicle dash mounted lamp, operates when the ABS is powered by the ISO 3731 (24S) or ISO 7638 wiring systems. If the ABS is powered through **only** the ISO 1185 (24N) stop lamp supply, then **only** the green trailer mounted lamp will indicate the ABS operational status.

6.1 TRAILER MOUNTED LAMP (GREEN)

This lamp is mounted on the trailer head board (see Fig 1.9) and is operated from the ISO 1185 connector when the ABS is powered only from the stop lamp power supply. i.e. when the brake pedal is pressed.

NOTE: If a permanent power source is available to the ABS from the ISO 3731 or ISO 7638 connectors, then system integrity will be indicated by a RED cab mounted warning lamp which becomes the primary ABS status indicator, the GREEN trailer lamp becomes the secondary indicator and will only operate:
(a) If the brake pedal is pressed **before** the ignition is switched on during initial power up.
(b) During a fault event when the red lamp is illuminated and the brake pedal is then pressed.
In either of these cases the trailer lamp will duplicate the red cab mounted lamp function.
At all other times the trailer lamp function remains dormant.

Lamp Sequence: Vehicle Stationary.
With the trailer ABS powered solely from the ISO 1185 connector, when the brake pedal is pressed the lamp will flash and then come on and stay on until the brake pedal is released at which point the lamp will go off.
NOTE: IF THE LAMP FAILS TO ILLUMINATE THEN THE LAMP, LAMP CIRCUIT OR ABS SYSTEM IS FAULTY.

Lamp Sequence: When the vehicle is moving at a speed greater than 6mph (10km/h):
The lamp remains off until the brakes are applied at which point the lamp will flash and remain off.
IF THE LAMP FAILS TO FLASH OR IF THE LAMP IS ON AT SPEEDS ABOVE 6mph (10km/h) WHEN BRAKING, THE ABS SYSTEM OR LAMP CIRCUIT IS FAULTY.

6.2 DASHBOARD WARNING LAMP (RED)

This lamp configuration will be fitted to towing vehicles which are equipped to provide a permanent power supply to the trailer ABS system via either the ISO 3731 (24S) or ISO 7638 electrical susies. In this event semi-trailer lamp function which is powered from the stoplight circuit will be secondary and the dash mounted lamp becomes the primary indicator for the ABS operational status.

Lamp Sequence:
At ignition switch on the lamp (red) will illuminate for approximately 2.5 seconds, then go out for 1 second, and then come on and stay on until the vehicle is driven at a speed above 6mph (10km/h) when the lamp should go off and stay off.
IF THE LAMP FAILS TO FLASH OR IF THE LAMP IS ON AT SPEEDS ABOVE 6mph (10km/h), THEN THE ABS SYSTEM OR LAMP CIRCUIT IS FAULTY.

6.3 CAB DASHBOARD LAMPS (RED and AMBER)

This lamp configuration may be fitted to some vehicles of European manufacture to suit particular types of ABS. The function of the red lamp is to indicate the operational status of the ABS. The function of the amber lamp is to indicate if ABS is fitted to the trailer. It is not however a mandatory requirement and if you have a vehicle with this lamp configuration you should refer to the vehicle manufacturer's handbook for further information.

6.4 MULTIPLE LAMP SEQUENCE (GREEN and/or RED)

The Modular ABS series incorporates an auxiliary lamp flash of three flashes.
The lamp will flash when the system is powered up when at rest.
This lamp sequence relates to :-

1. **Service due** - indicates that trailer or system service distance has been reached. After servicing the trailer or system the next service distance must be reset by using :
Info Centre (see Section 9.0 additional product information) or EOLT program (see Section 11.0)

2. NON ABS fault - A fault with a device connected to the ABS but not directly effecting the ABS. A function group 'A-' code will be generated. For example: a Reset-to-Ride height valve (COLAS) has been connected to the ABS, an 'A1' or 'RIDE A1' diagnostic code will be generated. This type of diagnostic code can be cleared by using :
DDU (see procedure in section 8.5)
Info Centre (see Section 15.0 additional product information)
EOLT program (see Section 11.0)

3. Odometer tyre scaling factor units mismatch - Where the odometer units (miles or km) do not match the service interval and current recording.
This can be checked and corrected as necessary by using the Info Centre (see Section 15.0 additional product information) or EOLT program (see Section 11.0)

4. Code 37 - An external device writing a 37 user display code to the ABS ECU to activate the multiple light sequence. Can be cleared by using : DDU (refer to Section 10.4, 10.5) or Info Centre. (see Section 15.0 additional product information)

6.5 IMPORTANT NOTE: SENSOR RELATED FAULTS

If a system fault occurs the warning lamp(s) will be illuminated. The ECU stores coded diagnostic information in a memory. If the diagnostic code stored, is in the group 11 to 16 or 21 to 26. i.e. Sensor related faults (see Diagnostic Codes in section 10.12) then after repair, on initial power up the lamp(s) will remain permanently illuminated without the initial flash. This is due to the fact that the ECU requires confirmation of satisfactory sensor outputs before it will restore the correct lamp sequence. The wheel(s) which had the sensor fault(s) must now be rotated with the ECU powered up, or the vehicle must be driven at a speed greater than 6mph (10km/h) to confirm sensor signal integrity. The ECU will restore the correct lamp sequence. However the fault code will remain in the memory and may subsequently be misleading if other faults occur at a later date. **Therefore the memory should have its stored faults erased immediately after undertaking any repairs.** (See section 10.4 and 10.5 for DDU or section 15.0 additional product information for Info Centre)

7.0 SYSTEM POWER SUPPLY AND FUSES.

7.1 POWER SUPPLY

1. MODULAR ABS will accept any source of electrical power available from the tractor unit as listed below.

(a) ISO 1185 (24 N Stop lamp power supply).

(b) ISO 3731 (24 S Permanent ignition sourced power supply).

(c)ISO 7638 (Dedicated ignition sourced permanent power supply).

Any of these supplies will power the system on a stand alone basis but trailers will be wired to provide a combination of either:

ISO1185 (24N) plus ISO 7638

OR

ISO1185 (24N) plus ISO 3731 (24S)

This provides operational choices to suit the majority of new and existing tractor units.
It should be noted that 24S with ISO 7638 is not available as an option.

2. The power source provided by the tractor unit will depend on its age, type of manufacture and modifications carried out by the operator.
The MODULAR system will only draw current from one power source at a time and will self select the available power source in the following order of priority:

(1st) ISO 7638 (Dedicated supply).
(2nd) ISO 1185 (24 N Stop lamp power supply).

OR

(1st) ISO 3731 (24 S Supplementary supply).
(2nd) ISO 1185 (24 N Stop lamp power supply).

7.2 System Fuses.

A 12 Amp in line ceramic fuse is fitted into pin 1 of the ISO 7638 Connector. In the event of a wiring short or other overload the fuse will blow resulting in a permanent lamp indication.
There are two designs of connector, varying according to manufacturer. (Type A = AMP, Type B = Haldex).
Both replacement fuse types are provided in Haldex service kit number 950 364 401.

Fuse Replacement kit

SERVICE KIT PART No. 950 364 401
CONTENTS:

FUSED PIN FOR Haldex ISO 7638 connector

FUSED PIN FOR A.M.P ISO 7638 connector
EJECTOR
RELIEF TUBE

INSTRUCTIONS

NOTE: The fused pin for A.M.P ISO 7638 cannot be used to replace the fused pin of the Haldex ISO 7638. Both fuses are supplied in the kit and are not interchangeable.

Fig 7.1 FUSE SERVICE KIT CONTENT

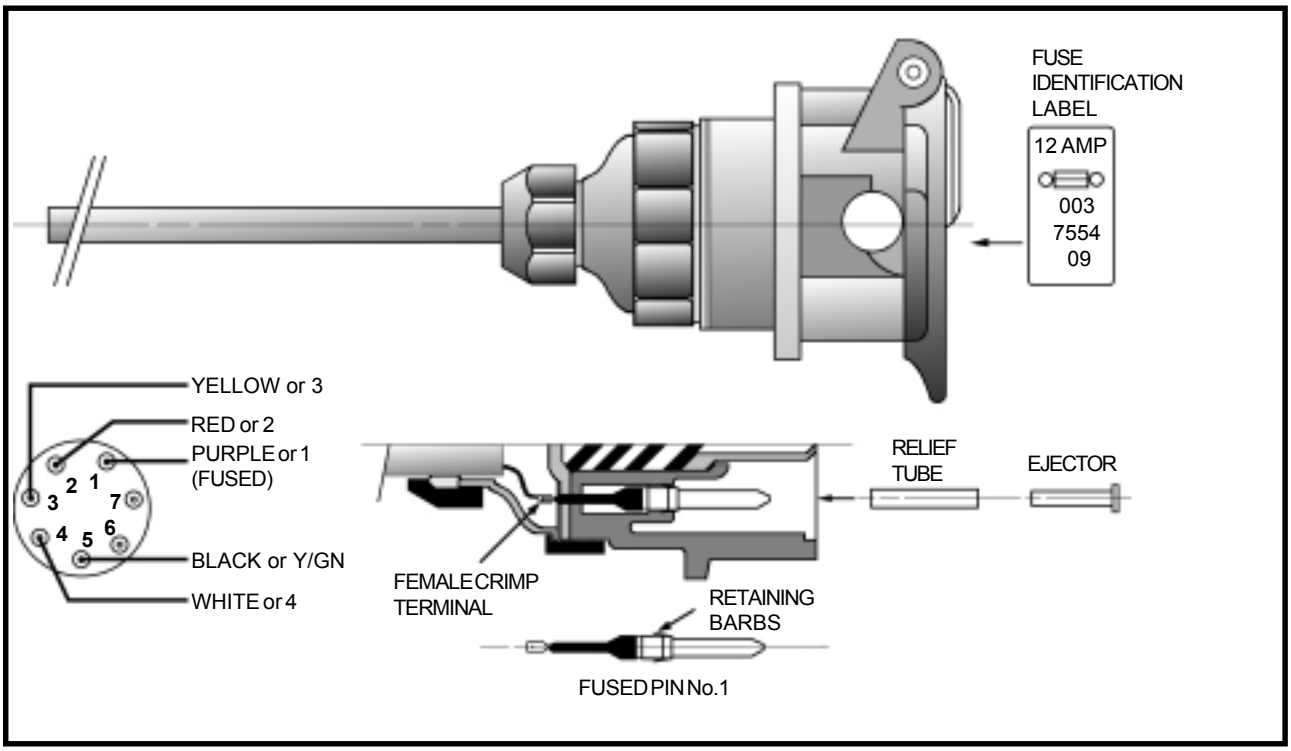


Fig 7.2. ISO 7638 FUSE REPLACEMENT A.M.P CONNECTOR

Replacement of ISO 7638 Fuse

PROCEDURE:
Type A:
A.M.P. Connector (Black Cover) See Fig.7.2.
1. Disconnect the trailer from all power sources.
2. Remove the fasteners securing the ISO 7638 connector to the trailer headboard.
3. Pull the socket away from the headboard to expose the cable gland.
4. Release the cable gland.
5. Unscrew the rear cover from the ISO 7638 connector and slide it away from the connector.
6. Pull back the gasket and gasket retainer, covering the pin compartment to gain access to the blade terminal of pin 1.
7. Disconnect the blade terminal from the fuse assembly.
8. Push the relief tool (in the service kit) fully home over the retaining barbs of pin 1.
9. Insert the ejector (in the service kit) into the relief tool and push it fully home to eject the pin from its housing.
10. Fit the replacement (fused pin 1) and reassemble the connector (in reverse procedure) ensuring correct location of all gaskets and security of all gland nuts, and fittings.

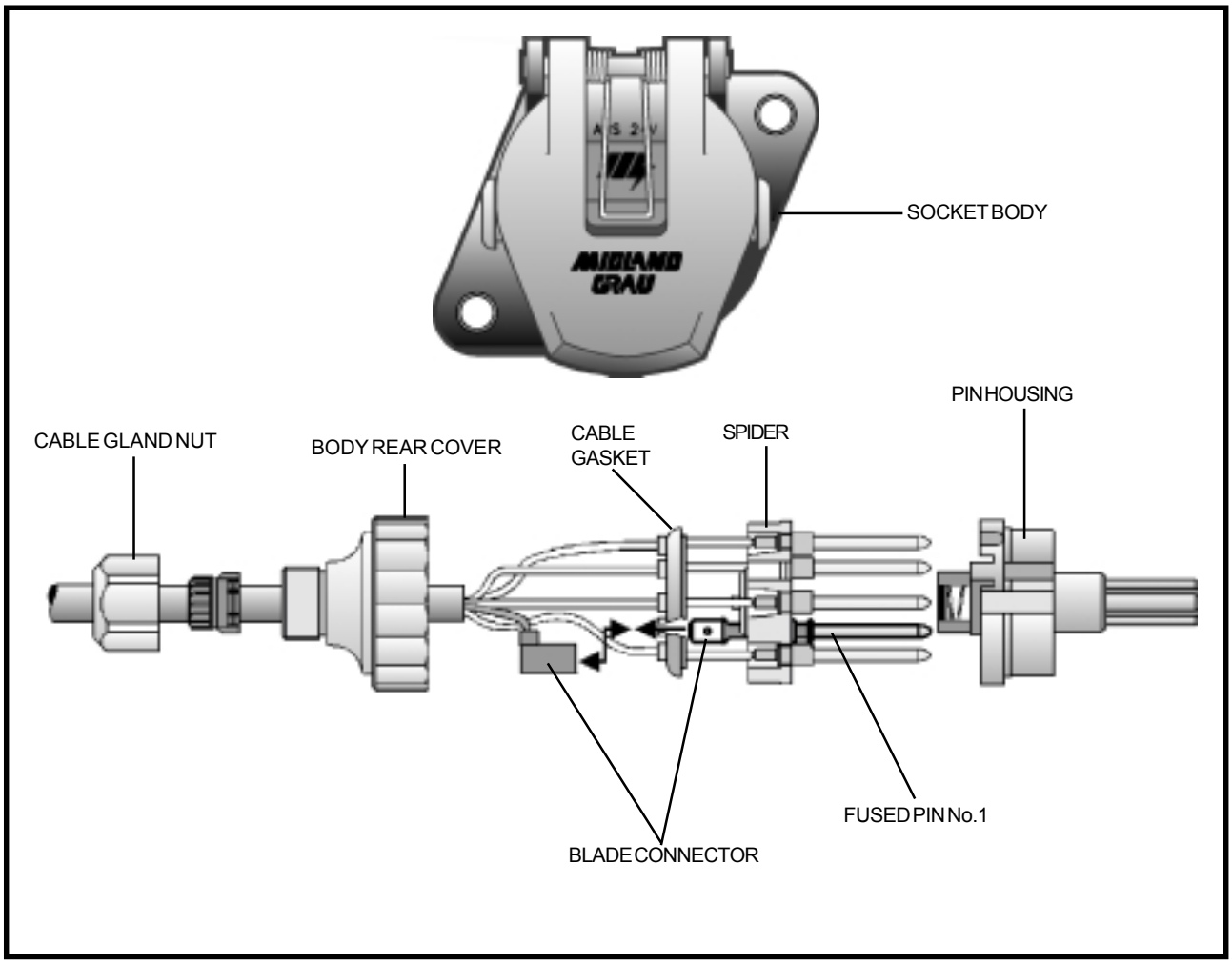


Fig 7.3. ISO 7638 FUSE REPLACEMENT HALDEX CONNECTOR

Type B:
Haldex Connector (Green Cover) See Fig.7.3.
1. Disconnect the trailer from all power sources.
2. Remove the fasteners securing the ISO 7638 connector to the trailer headboard.
3. Pull the socket away from the headboard to expose the conduit and cable gland.
4. Unscrew the cable gland nut from the socket body rear cover.
5. Unscrew the rear cover from the connector body and slide it away from the connector.
6. Withdraw the spider and pin housing assembly from the socket body, and disconnect the fused pin blade connector.
7. Slide the cable gasket along the cables, away from the spider to clear the fused pin blade.
8. Separate the spider and pin housings by prising them apart to disengage the retaining barbs.
9. Pull pin 1 sideways out of the spider, and insert the new fused pin into its housing in the same orientation.
10. Re-assemble the connector in the reverse procedure ensuring correct location of all gaskets and security of all gland nuts, and fittings.

8.0 SYSTEM CONFIGURATIONS

8.1 TERMINOLOGY (see also section 1.1)
S Refers to a sensor.
M Refers to a modulator.
S1A/S1B, S2A/S2B and S3A/S3B identify the left and right hand of sensor pairs and the order in which they are installed on the trailer.
Consider sitting on axle 1 with axle 2 behind you, then sensor group "A" will always be to your left and sensor group "B" will always be to your right. You will note that for this to be true you will be facing forwards for full trailers and backwards for semi or centre axle trailers.
The configuration reference indicates component quantities in the system. Hence a 2S1M system will have 2 Sensors and 1 Modulator.
The sensor identity is relevant to the position in which its output is displayed on the DDU or Info Centre, when checking sensor function (see section 3.5 and 6.0). The sensor identity varies between different configurations dependant on the number of axles and sensor pairs fitted.
NOTE: These identities should not be confused with axle numbers, which differ between full trailers and semi or centre axle trailers. (See Figs 8.4 to 8.5).

ECU Refers to the electronic control unit of the MODULAR ABS system.

Axle numbering:
Semi-Trailer and centre axle trailer axles are numbered from the rear axle forwards hence axle 1 is the rear axle.
Full trailers (Drawbars) have their axles numbered from the front of the trailer rearwards so that the front axle is number 1.
This numbering system caters for self steering axles which will always be number 1.
If axle 1 is a self steer axle it must always be controlled by the RED modulator channel operating on a “select low” principal, i.e. the ABS channel controlling that axle reacts to the first locking wheel and controls both wheels of the axle to that level of tyre to road grip.
It is not possible to provide individual wheel control on self steer axles as split friction conditions would result in vehicle instability due to the differing tyre to road grip across the axle, which would cause it to self steer.

8.2 CONFIGURATION
Sensor and modulator channels are colour coded as follows.
RD = RED, BU = BLUE, YE = YELLOW

The **RED** channel sensing is always from sensors identified as S1A and S1B.
This channel provides select low operation as independant wheel control ABS cannot be applied to self steer axles.

The **BLUE** channel sensing is always from sensor(s) identified as S2A or S2A and S3A together:

The **YELLOW** channel sensing is always from sensor(s) identified as S2B or S2B and S3B.

MODULAR ABS is capable of controlling 1 or 2 channels of braking effort sensed by 2 or 4 sensors and may therefore be installed in a range of different configurations:

Modular 1 Upgrade =	2S1M
Modular 1 Plus =	2S1M
Modular 2 =	2S2M or 4S2M

System equipment will depend on the type of trailer, and the degree of ABS control specified by the operator or trailer manufacturer. The maximum number of control channels will be two, determined by the number of modulator(s).

Modulator cable connected to ECU:	Number of ABS control channels:
Red (RD) only	1
Yellow (YE) & Blue (BU) only	2

Fig 8.1 NUMBER OF CHANNELS

Wiring diagrams are shown in section 12. The number of wheel speed sensors connected to the ECU may be 2 or 4 but the combination of modulator solenoid cables and wheel speed sensor cables will always be as shown in Fig 8.2 below.

Modulator cable is connected to:	Sensors connected
For 2S1M	
RD	S1A+S1B
For 2S2M	
BU+YE	S2A+S2B
For 4S2M	
BU+YE	S2A+S2B+S3A+S3B

Fig 8.2 SENSOR AND SOLENOID CABLE COMBINATIONS

8.3 CONFIGURATION CODES

NOTE:- Where sensed axles are also lift axles,the sensors will be disabled when the axle is lifted, these are indicated in brackets in Fig 8.3 below.

DDU Code	Info Centre Code	Function	Axle No. Lifted	Sensors Used	Modulators Used
CO	2S1C CO	2S/1M		S1A S1B	Red
C1	2S1C C1	2S/2M		S2A S2B	Blue,Yellow
C2	2S2C C2	4S/2M		S3A S2A S2B S3B	Blue,Yellow
C3	4S2C C3	4S/2M	2 or 3	(S3A) S2A S2B (S3B)	Blue,Yellow

Fig 8.3 CONFIGURATION CODES

8.4 CONFIGURATION FAULTS

When the ECU is initially powered up, a system configuration code is briefly displayed on the DDU or Info Centre if attached, which should be confirmed as correct for the particular installation, by referring to the configuration codes listed in Fig 8.3 above.

If a vehicle has its modulator piped incorrectly, solenoid wiring interchanged between solenoids, or sensor wiring interchanged between sensors then it is possible that a correct configuration code may be displayed but that poor ABS performance is evident. This will occur due to incorrect cross connection of sensors and modulators at the ECU.

When the ECU receives a locking wheel signal it attempts control of that wheel, but if sensors or modulators are incorrectly connected either electrically or in the case of the modulator pneumatically, the wrong wheel will be controlled, resulting in poor ABS and brake performance.

In such circumstances the MODULAR system may generate a fault code indicating slow wheel recovery group i.e. A fault code number such as, 41, 42, or 43. (see section 10.0)

In this event the configuration and wiring diagrams should be checked against your installation to ensure that the actual pipe work and wiring conforms to the allowable configuration details, (See section 12.0).

8.5 AUXILIARY CONFIGURATION CODE

Modular 1 Plus and Modular 2 ABS ECUs offer extra features beyond the ABS, However these features may or may not be used. In order to provide the standard of electrical diagnostic associated with ABS type product, the ECU needs to know if a solenoid operated valve, e.g. a Reset-to-Ride (COLAS) valve, should be present.

The ECUs are supplied in a un-configured condition, this means that when it is powered after being installed on a vehicle it will check for the presence of a solenoid operated valve and configure to use one if it is present. If auxiliaries are added later which require the use of features which are already disabled by the first auto configuration a fault code will be displayed.

For example: If a Colas valve has been added since initial configuration the diagnostic code will be :-

DDU display = A1

Info Centre display = RIDE A1

this will be seen by the ECU as a current fault.

Using the **DDU** the procedure to clear this configuration is as follows:-

1. Apply power, allow display to settle to fault code 'A1'

2. Read fault code, obtain 'CA' (or if no other stored fault codes '00') and accept option by pressing the button on DDU.

3. Wait approx 5 sec. after display has returned to 'A1'.

4. Repeat reading and clearing of fault code as above up to three times.

5. On the third time the 'CA' will have been replaced by a 'CC'. Accept this option by pressing and holding the button.

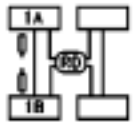
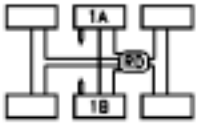
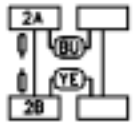
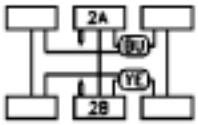
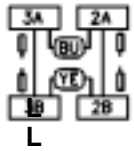
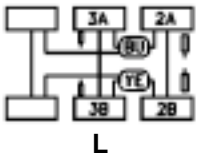
6. Remove power.

7. Apply power, the diagnostic display should show the main 'C' configuration followed by the configuration 'A1', then '07' .
The ECU is now re-configured.
8. Erase diagnostic code 'A1' from memory.

Using the **Info Centre** the procedure to clear the configuration is detailed in the Additional Information section 15.0.

8.6 CONFIGURATION AND FUNCTION CHECK

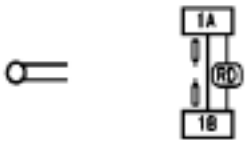
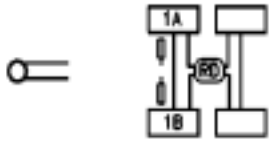
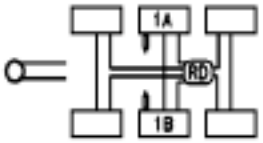
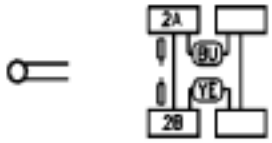
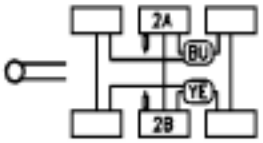
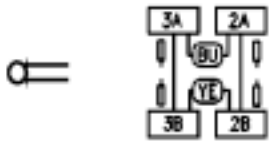
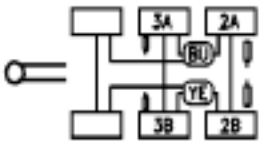
In the event of needing to identify the configuration, match your trailer details to those shown in Fig 8.4 or Fig 8.5 i.e. Type of trailer, Number of axles, modulators and sensors fitted. (see also Figs 8.1 and 8.2)
Having determined this information, Fig 8.4 or Fig 8.5 can be used to determine the configuration layout applicable to your trailer.
Having determined your trailer layout, refer to the corresponding section diagram from Fig 8.6 which shows the correct checkout procedure in the order:
1. Lamp sequence.
2. Modulator blowdown check (see section 5.7)
3. Sensor output indication on DDU or Info Centre when a wheel or wheels are rotated.

Semi-Trailer	1	2 1	3 2 1
2S/1M	N 2	 N 3	 N 3
2S/2M	N 2	 N 4	 N 4
4S/2M		 L N 4	 L N 4

NOTES:	
N1	Details viewed from above.
N2	2 Delivery port ABS valve assembly (preferred).
N3	6 Delivery port ABS valve assembly.
N4	3 Delivery port ABS valve assembly.
N5	**L** = Axle which may be a lift axle.
N6	For actuation recommendations consult Haldex Brake Products Ltd. Technical Service.

NOTE: The above diagrams illustrate the most common installations. For alternative configurations consult Haldex Brake Products Ltd. Technical Service.

Fig 8.4 MODULAR SYSTEM SEMI TRAILER CONFIGURATION LAYOUTS

Centre Axle Trailer	1	2 1	3 2 1
2S/1M	 N 2	 N 3	 N 3
2S/2M	N 2	 N 4	 N 4
4S/2M		 L N 4	 L N 4

NOTES:	
N1	Details viewed from above.
N2	2 Delivery port ABS valve assembly (preferred).
N3	6 Delivery port ABS valve assembly.
N4	3 Delivery port ABS valve assembly.
N5	**L** = Axle which may be a lift axle.
N6	For actuation recommendations consult Haldex Brake Products Ltd. Technical Service.

NOTE: The above diagrams illustrate the most common installations. For alternative configurations consult Haldex Brake Products Ltd. Technical Service.

Fig 8.5 MODULAR SYSTEM CENTRE AXLE TRAILER CONFIGURATION LAYOUTS

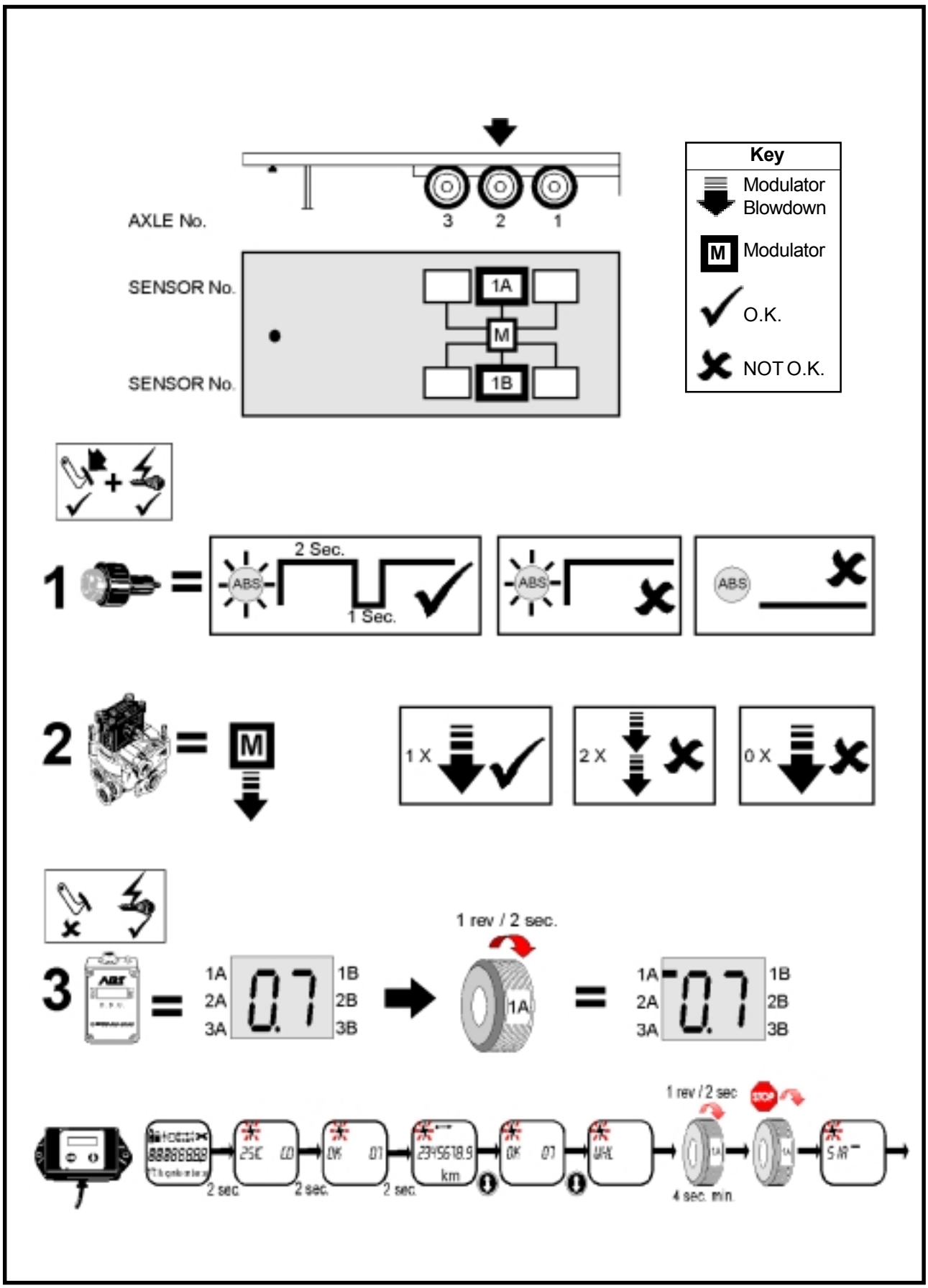


Fig 8.6 MODULAR 1 (2S/1M) SYSTEM CHECKOUT

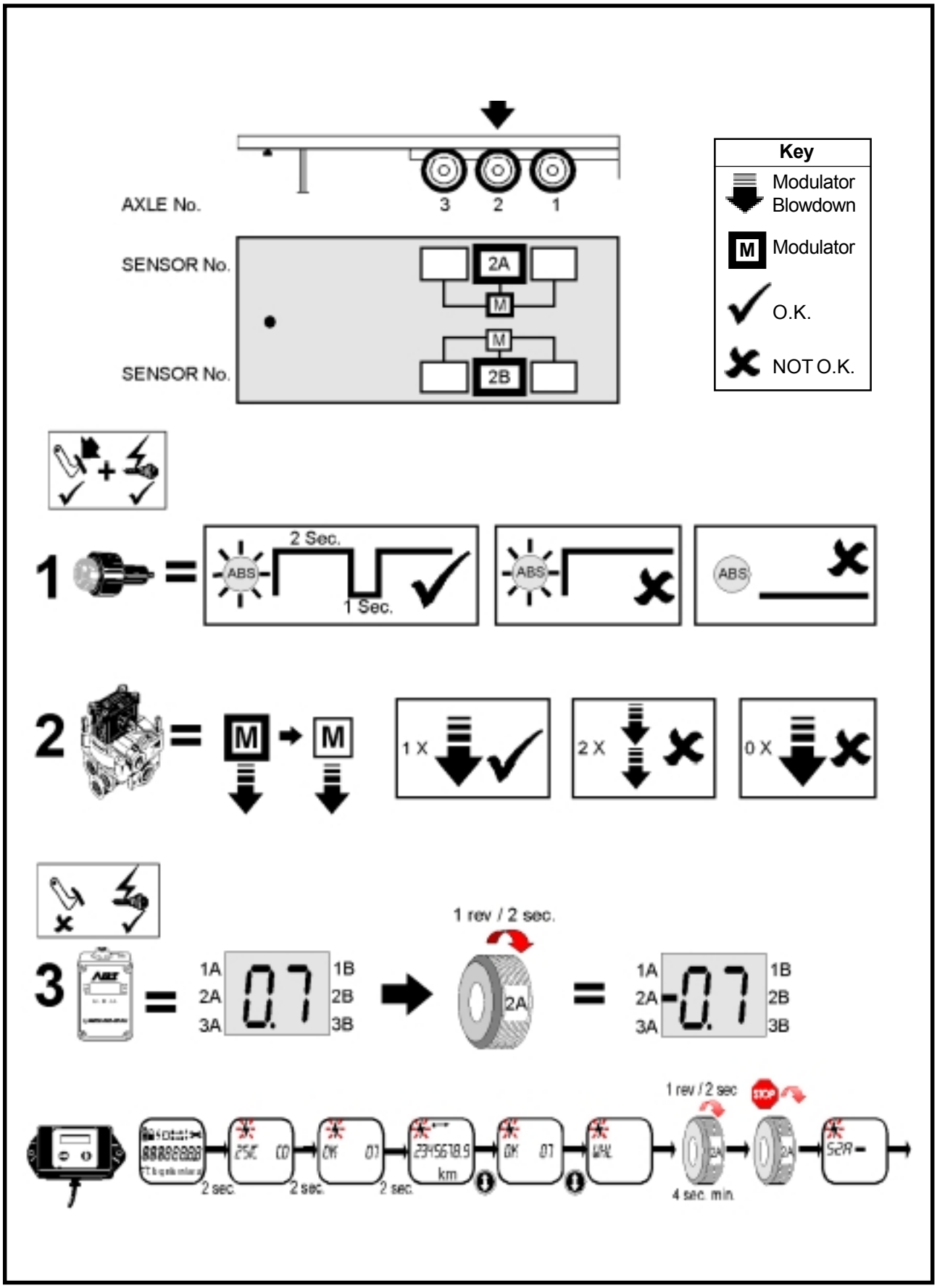


Fig 8.7 MODULAR 2 (2S/2M) SYSTEM CHECKOUT

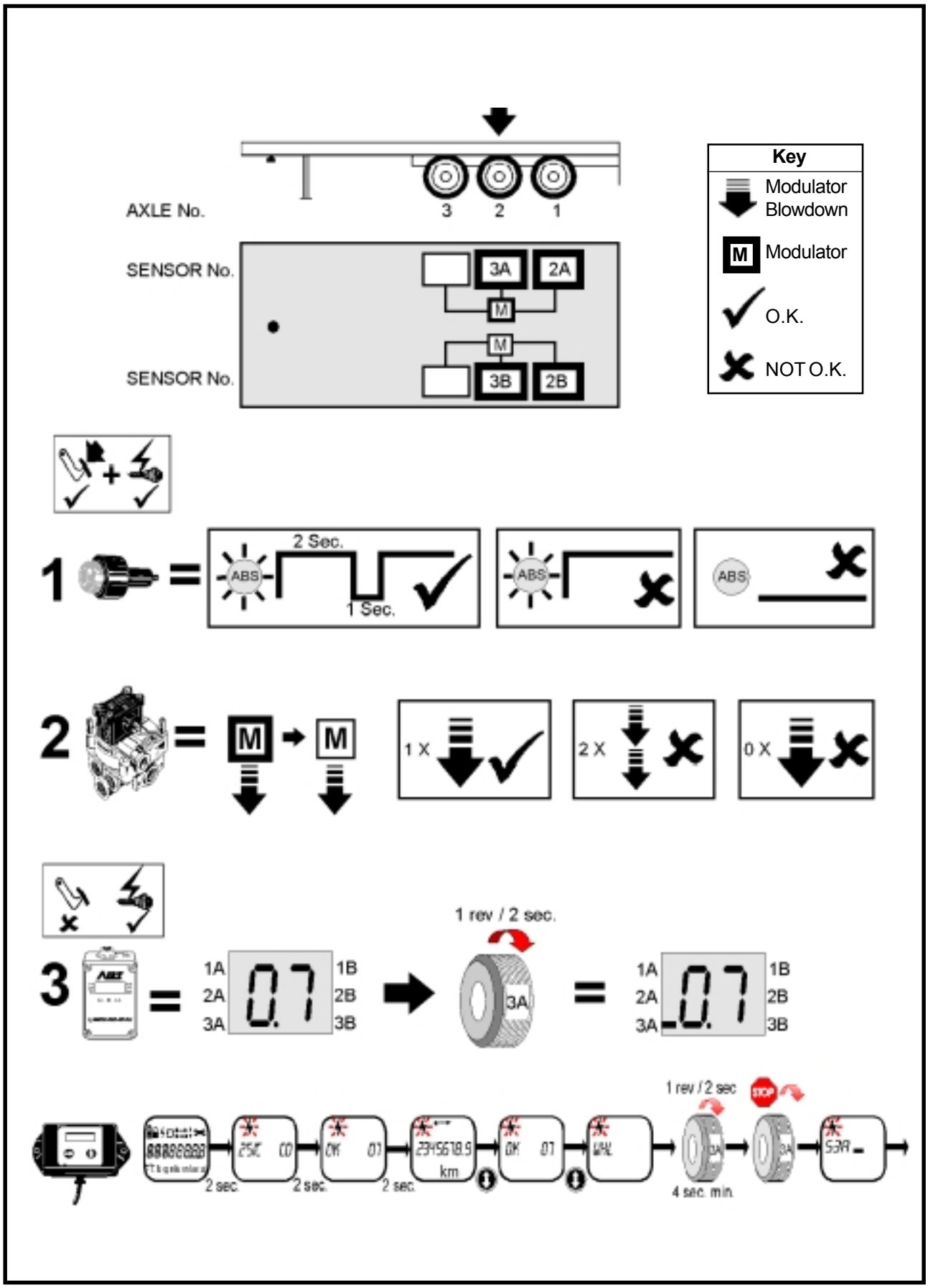


Fig 8.8 MODULAR 2 (4S/2M) SYSTEM CHECKOUT

9.0 THE INFO CENTRE

The Info Centre is a side of trailer mounted diagnostic unit used for read-out of odometer and diagnostic codes, plus other information as available from the ABS Electronic Control Unit (ECU). (See Fig 9.1)

Fig 9.1 INFO CENTRE

It is connected permanently to the ABS ECU's diagnostic connection. While the ECU is powered from the vehicle system. (stoplight or permanent supply) information is transferred to the Info Centre's memory, which can be recalled. Power is supplied from the vehicle systems via the ECU diagnostics connector. (see Section 12.0 - Wiring diagrams)

The Info Centre comprises an LCD (Liquid Crystal Display) (see Fig 9.2) and buttons marked up/down (⇕) and right (➡). The ⇕ button accesses the next main menu item, the ➡ button is used for sub menu items. For adjustment of settings a watch adjustment style procedure is followed; Hold down the ➡ button for 2 seconds, the first digit flashes and can then be increased by pressing the ⇕ button. The next digit is then selected, and so on. It also has an internal battery which allows display of information (including fault indication) when the trailer is uncoupled and unpowered. It is housed in a plastic enclosure provided with a cover boot for environmental protection.

The Info Centre contains an AA size Lithium / Thionyl Chloride Battery that carries the following warning: **"Fire, Explosion and Severe Burn Hazard".** Under no circumstances should the battery be recharged, crushed or tampered with in any way. The Info Centre should not be Incinerated or stored above 100°C. The ABS ECU may be disposed of by landfill or recycled through a specialist operator, if in doubt consult your local authority for details or contact Haldex.

Functions:

Odometer:	Total distance Trip distance Service interval Distance to next service Tyre scale setting
Diagnostic	Display current diagnostic code Display stored diagnostic codes Sensor / cabling check
ECU Information:	Serial number Product type code Configuration code Auxiliary code Re-Configure ABS ECU (adding or removing COLAS)

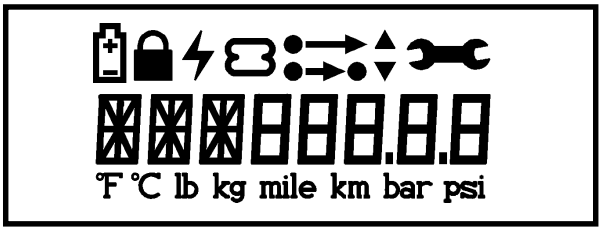


Fig 9.2 THE DISPLAY

The Legends are as follows:-

BATTERY:
- OFF = OK
- ON = Internal ABS ECU battery failure. Diagnostic functions and ECU information available only.

LOCK:
- Incorrect ABS ECU connected to Info Centre.
Odometer functions not available.

POWER: Vehicle Power
-ON = Vehicle Supply ON
-OFF = NO Vehicle supply
-FLASHING = Communications established between Info Centre and ABS ECU.

BELLOWS: Air Suspension -
- Bogie load, Load apportioning, Height control, Manual raise/lower

ODOMETER DISPLAY
- Total distance
- Trip distance

ADJUSTMENT ARROWS: Editing Mode
-ON = Indicates that information may be changed by user.

SERVICE FUNCTION / SERVICE DUE:
-ON = Whilst displaying the odometer value indicating service is due.
-FLASHING = Current ABS fault

9.1 INFO CENTRE FOR ADR REGULATIONS

To satisfy the ADR regulations for flammable loads (i.e. Petrol tanker trailers) a variant of Info Centre and its associated ECU (see section 4.0) is available WITHOUT odometer function.This is because hazardous load regulations do not permit the fitting of battery powered equipment (spark generators) to the rear of the firewall and so only this variant of Info Centre must be used.

All other functions are as standard Info Centre . For reference of the component part number refer to service parts in section 14.0.

This Info Centre must only be replaced by its exact equivalent on ADR vehicles.

9.2 INFO CENTRE MAINTENANCE

The Info Centre requires no routine maintenance.

9.3 INFO CENTRE REPLACEMENT

1. Locate the position of the unit which should be in an accessible area either in front, rearward of the wheel gear.
2. Disconnect the Info Centre connections.
3. Cut away the cable ties securing the cable to any appropriate supports.
4. Unclip the front cover to expose the two M6 mounting bolts and remove.
5. Fit the new Info Centre in the reverse procedure to the above noting the following.
a: Tighten the retaining bolts to 12-15Nm.
b: Tighten nut on Info Centre socket and ensure locking tab is located when mated with chassis diagnostic connector. (see Fig 9.3)

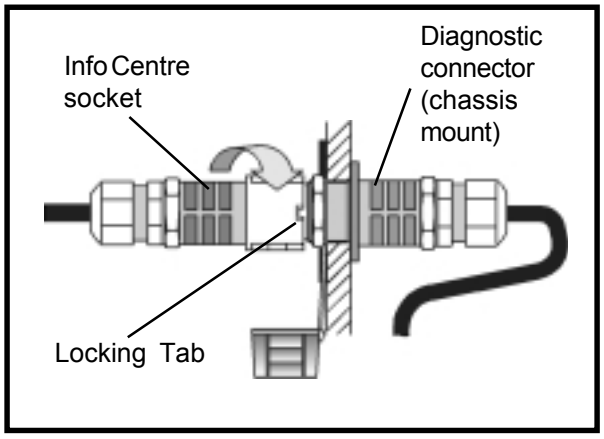


Fig 9.3 CHASSIS CONNECTION

c: Secure cable along the chassis or appropriate support with cable ties at not more than 200mm intervals.
d: Mate cover to Info Centre and click into position making sure both clips are fully engaged at top and bottom. (see Fig 9.4)

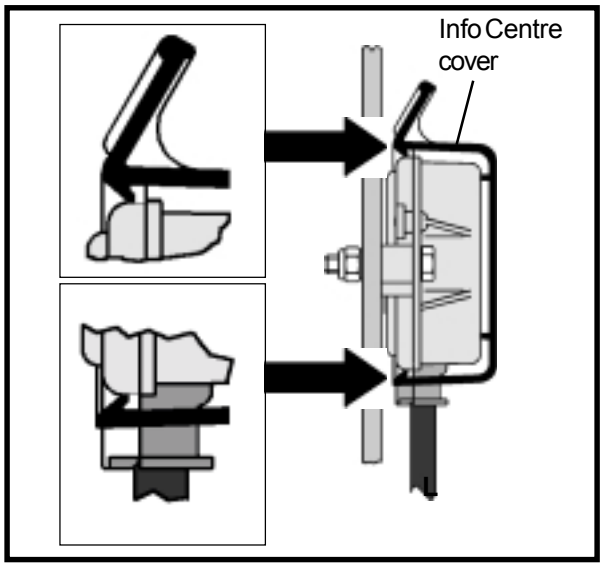


Fig 9.4 COVER CLIPS LOCATION

9.3 FUNCTION INSTRUCTION

Refer to Section 15.0 for the relevant product information on various functions of the Info Centre with and without vehicle power.

10.0 FAULT FINDING WITH MODULAR

10.1 EQUIPMENT REQUIRED

The following tools are required to carry out the complete schedule of diagnostic tests.

Trolley jack
Multimeter (see recommended units in Sec.14.0)
500 volt insulation tester
Switch test box (optional see Fig 10.1).
Diagnostic Display Unit (DDU) or Info Centre.

NOTE: A tractor unit may be used as an alternative to a switch test box.

CAUTION : It is essential that normal safety procedures are observed when working on vehicles to ensure that they are correctly jacked and supported. Dangerous load carrying vehicles should always be made safe before commencing remedial work.

10.2 INITIAL DIAGNOSIS OF ABS FAULTS

Perform the following tests.

1. Apply electrical power to the trailer via the"24N" connector while observing the anti-lock warning lamp which should flash and then come on and stay on. (See section 6.0 lamps).

2. If the lamp fails to illuminate check the lamp bulb and electrical power supply.

3. If the lamp fails to flash but stays permanently illuminated check the diagnostic display codes including stored diagnostic codes using the procedure in 10.3. (Also NOTE section 6.5)

4. If (1) above is satisfactory drive the vehicle at above 6 m.p.h. (10 km/h). The anti-lock warning lamp should extinguish. If it does not there is a wheel speed sensing fault. Check the diagnostic display code using the procedure in 10.4.

5. To test for correct valve blow down, fully charge the air brake system, and turn off all electrical power to the trailer. Apply the foot brake and set the ignition switch to on.
There should be as many brief pulses of air as there are ABS modulators. (See section 5.7and Fig 8.6 to 8.8).

7. If the air pulse is incorrect check the diagnostic display code using the procedure in 10.4. Note that erroneous wiring of the modulator solenoid wiring will produce two air pulses on the affected modulator as the dump and hold solenoids are electrically identical but have different pneumatic functions.

8. When a wheel is rotated, and electrical power is applied, all modulator blowdowns are inhibited while the wheel is turning.

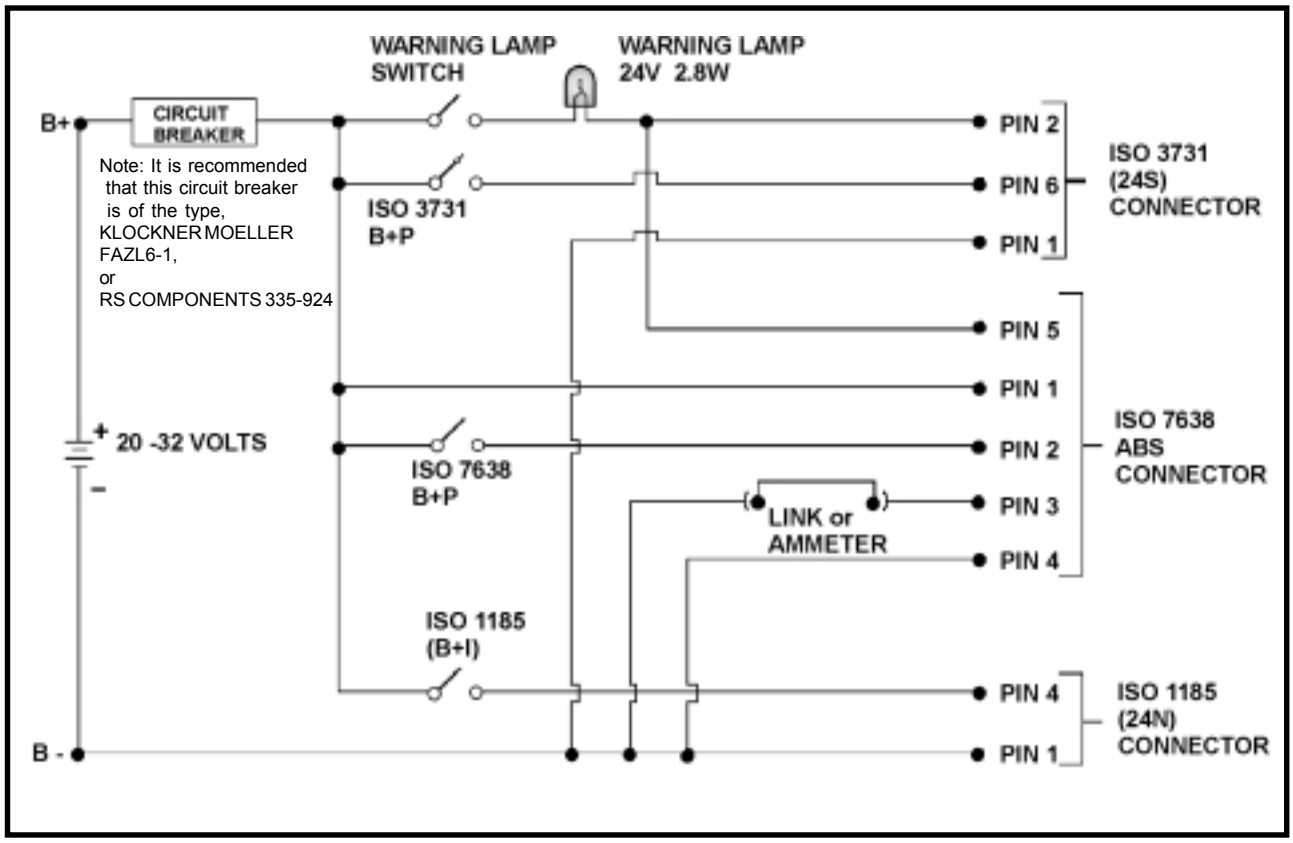


Fig 10.1 CIRCUIT DIAGRAM FOR OPTIONAL SWITCH TEST BOX

10.3 DIAGNOSTIC DISPLAY

The ECU has a memory which stores diagnostic codes automatically. These stored codes are retained in memory even when power is disconnected from the ABS, and can be recalled on a hand-held Diagnostic Display Unit (DDU) when the power supply is restored.
Follow the appropriate procedure described in section 10.4 for use with the DDU and section 15.0 (Additional information) using the Info Centre.
For wheel sensor output tests the DDU may be used on a trailer which is static in the workshop or dynamically on the road. The Info Centre can be used on a trailer which is static in the workshop only.

10.4 USING THE DIAGNOSTIC DISPLAY UNIT (DDU)

1. Remove all electrical power from the trailer.
2. Connect the DDU cable to the trailer diagnostic output connector. (See Fig 9.3).
3. Apply 24 volts to the anti-lock system.
4. At power up 88 is displayed briefly to confirm LCD function, followed by a configuration code and a diagnostic code which is displayed constantly. Check that the configuration code agrees with the system wiring by confirming that the number of connected sensors and solenoids are as shown in the configuration codes given in section 8.3.
5. Refer to diagnostic codes in section 10.12 to determine the cause of the fault.
Note that some codes generated confirm correct system function.
6. Remove all electrical power and then repair faults as necessary.
7. Clear the diagnostic memory as described in 10.5
NOTE: Faults which occur whilst the ECU is powered up are logged in two memories. Any attempt to erase the permanent memory unless power has been removed since the fault occurred will be unsuccessful as the temporary memory will continuously re-write the fault to permanent memory at each erasure attempt.
8. Remove electrical power from the ABS system (the diagnostic display will be completely blank).
9. Disconnect the DDU cable from its connector.
10. Restore electrical power and carry out the driver's checks for correct lamp sequence as described in section 1.2 but with regard to the **Important Note** at section 6.5.

10.5 READING STORED CODES ON THE DDU

1. Remove electrical power from the ECU.
2. Connect the Diagnostic Display Unit to its connector on the trailer.
3. Apply power to the ECU.
4. Read the display on the DDU. This is the current code which may or may not refer to a fault
5. Press the switch on top of the DDU for approximately 5 seconds until the DDU display changes.
6. Release the switch.
7. The DDU displays the code last entered.
8. Press the switch again for approximately 5 seconds until the DDU display changes.
This is the highest numerical fault code in memory.
9. Release the switch, and press again to display the next highest numerically recorded fault code. Continue this sequence to step through the fault code memory.
10. After five codes “CA” will be displayed. See 12. below.
11. Release the switch.

ERASING FAULT CODES FROM MEMORY USING THE DDU

12. The ”CA” display is an invitation to erase the memory, pressing and holding the switch while it is displayed will cause the memory to be erased. The LCD will scan the codes as they are cleared.
13. If the switch is not pressed the next fault code in the stored list will be displayed.
14. At the end of the fault code list "CA" will be displayed again as a further invitation to erase all stored faults. Successful erasure of the fault codes will only be possible, if the fault causing the code to be logged in memory has been repaired.
15. When all codes are cleared, release the button briefly, then press and hold. After 5 seconds the display will read "00" indicating that the memory is empty.

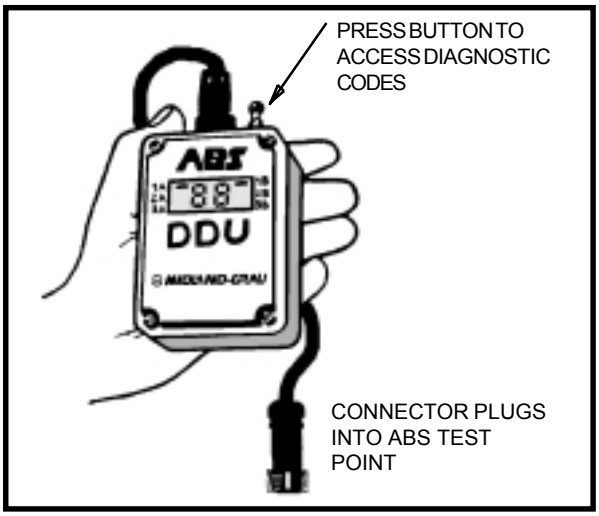


Fig 10.2 ACCESSING FAULT CODES USING THE DDU

Using the **INFO CENTRE** see Section 15.0 for relevant product information.

10.6 INTERPRETATION OF FAULT CODES

1. When the vehicle is stationary and no fault is present the diagnostic display will be 07.
2. This display will change when the vehicle is driven at above 6 mph (10 km/h) and bars will appear in the display window for left and right sensors representing a sensor output which is above the necessary minimum.
3. The number of bars which appear should be the same as the number of wheels which have speed sensors fitted.
4. The (DDU) displays “00” as a code which indicates correct operation of the system, when vehicle speeds exceed 6mph (10km/h).
5. When the vehicle stops the code returns to 07.
6. Flashing bars indicate that there are poorly adjusted sensors or loose sensor connections.
7. Spinning individual wheels with the trailer jacked up will cause the relevant bar to appear if the sensor output is above the minimum.
8. Codes other than those described above can be interpreted by using the diagnostic code table in section 10.12.

10.7 ELECTRICAL TESTS OF SENSOR AND SOLENOID WIRING

1. When the diagnostic code indicates that there is a faulty power supply, wheel speed sensor or modulator solenoid fault, the location of the fault can be determined by continuity and resistance tests and by reference to the appropriate wiring diagram.
2. Test equipment may be connected to the main ABS harness at the moulded ECU connector for which a pin map is shown in Fig.4.7, Fig.4.8 and Fig.4.9 .

10.8 POWER SUPPLY FAULTS

The correct power supply connections to the ECU pins are shown in the pin map in Fig.4.6, Fig.4.7 and Fig.4.8 .
Supply voltages must be in the range 18 to 32 volts maximum.

Code 90 indicates a voltage loss when a solenoid is energised and the voltage at the ECU falls below 18 Volts.
1. Ensure that the electrical supply is satisfactory under full electrical load conditions, i.e. there are no high resistance connections present.
2. Establish if the voltage drop occurs when using each of the power sources on their own, ISO7638, ISO3731 (24S), ISO1185 (24N).
3. Check for loose connections in the wiring from the source which produces the fault code.
NOTE: An inadequate power supply e.g. discharged test batteries will cause code 90 to be displayed.

Code 91 indicates that when using the ISO 7638 power source there is sufficient voltage coming from pin 2 of the ISO 7638 connector but the voltage coming from pin 1 is low or absent.
1. Check for broken wiring or blown fuses on both the trailer and the towing vehicle or with the workshop power supply if used. The voltage measured on the ECU connector which goes to ISO 7638 pin 1 should be between 18 Volts and 32 Volts when the voltmeter negative lead is on the ECU connector which goes to ISO 7638 pin 4. (See wiring Section 12)

Code 92 indicates that the power supply to the ECU is above 32 volts and action must be taken to reduce this over voltage.
1. Check the towing vehicle voltage regulator and alternator system or the voltage output from the test power supply in use.
2. The correct power supply connections to the ECU supply pins are shown in the pin maps in Fig.4.7, Fig.4.8 and Fig.4.9 .

10.9 WARNING LAMP FLASH INCORRECT
Permanently Illuminated Lamp

1. This may be caused by wiring shorts or by faults which cause the ECU to permanently illuminate the lamp. The latter may be due to a system fault if the code displayed is not 07, or a stored sensing system fault, if the code displayed is 07.
2. Read the diagnostic code. If the code is 07 read the fault memory. Sensing system faults will be stored if any were present the last time the trailer was moved at a speed greater than 6mph (10km/h).
3. Make any necessary repairs and clear the memory. The lamp flash should now revert to normal after vehicle speed has exceeded 6mph (10km/h). **IMPORTANT**: See section 6.5.
If not there is a lamp wiring short circuit to battery negative or chassis.
4. If the code is not 07 make the necessary repairs as indicated by the diagnostic code until the code becomes 07 at which time the lamp sequence should revert to normal within the provisions of section 6.5

NOW ERASE THE MEMORY.

5. If after completing the above process the lamp is still permanently illuminated there is a short circuit between the lamp negative side and battery negative. The lamp negative goes directly to the ECU. The ECU then switches this side to battery negative to illuminate the lamp.
6. Measure the resistance of the relevant lamp wire

to battery negative and vehicle chassis to confirm the short.

No Lamp Illumination
1. Check the lamp bulb and holder first.
2. Connect a test lamp temporarily across the lamp terminals in the junction box, and cycle the system.
3. The test lamp will operate correctly if the fault lies downstream of the junction box. i.e. between the trailer lamp and junction box.
If the lamp sequence is incorrect the fault lies upstream of the junction box towards the ECU.

10.10 WHEEL SPEED SENSING

Codes 01 and 02 indicate that a wheel speed sensor or its wiring is short or open circuit.
1. Disconnect the relevant sensor connector at the extension lead plug and measure the resistance between the 2 sockets in the connector housing.
2. The ohmmeter reading should be between **980 ohms and 2.35 kohms.**
3. The extension cable between the controller and wheel has an in line connector. If an open circuit is measured check that the connector is correctly assembled.
4. Disconnect the harness from the ECU and locate the appropriate pins for the cable to be tested see Fig.4.7, Fig.4.8 and Fig.4.9 .
5. Using a 500 volt insulation tester measure the insulation resistance between each sensor wire and chassis. The insulation resistance must be more than **10 megohms.**

Codes 11 and 12 indicate that the output of a wheel speed sensor is insufficient. The most likely reason for this is that the sensor to exciter gap is too great. Adjust the sensor as detailed in section 3.4.

Codes 21 and 22 indicate that there is an intermittent loss of adequate sensor signal when moving. The most likely causes are loose connections, loose sensor bracket, broken sensor retaining clip, a distorted exciter or intermittent insulation failures of sensor cables (for which a cable insulation test will be required).

10.11 MODULATOR SOLENOIDS

Codes 61 and 67 indicate that the solenoid or its cable is open circuited.
1. Disconnect the solenoid cable at its connector and measure the resistance.
2. The resistance should be between **12 ohms and 20 ohms.**

Codes 71 and 77 indicate that a solenoid or its cable is short circuited.

Codes 80 to 87 indicate that a solenoid or its cable has a short circuit to battery positive.
1. Disconnect the harness connector from the solenoid. Measure the resistance of the solenoids with a multimeter at the modulator. Solenoid resistance should be **12 to 20 ohms**.
2. Disconnect the harness at the ECU and test at the solenoid connector between each wire and chassis with a 500 volt insulation tester. The insulation resistance must be greater than **10 megohms.**

Note:If an unlisted diagnostic code is displayed on the DDU, then the ABS ECU is faulty and must be changed.

NOTE: Wherever possible alternative components may be substituted for existing ones during fault finding, if the substituted component eliminates the current diagnostic code then it may be assumed that the component that was causing the code to be displayed is at fault.
If the code cannot be eliminated then the ABS ECU is at fault.

DIAGNOSTIC CODES.
Diagnostic codes are listed on the following pages and are separated into groups covering numeric codes, and alpha numeric codes, these are followed by the configuration codes which will be seen at power up of the ABS ECU.

10.12 DIAGNOSTIC CODES FOR MODULAR ABS SERIES

Note: If a diagnostic code not listed below is displayed, the ECU is suspect and should be changed. Refer to 10.5 for detailed diagnostic procedures. A diagnostic code list, as displayed on the DDU, is shown in this section. For the Info Centre diagnostic code listing refer to relevant information in section 15.0.

CODE DISPLAYED

BLANK DISPLAY — No supply on ignition switched line.
Possible causes:
Fuse blown.
DDU / INFO CENTRE or cable fault.Open circuit B -

SENSOR BAR — Bar displayed = Sensor output O.K.
Bar not displayed = Sensor output too low

00 — System is O.K. vehicle is moving
01 — 1A Sensor/wiring open or short circuit
02 — 1B Sensor/wiring open or short circuit
03 — 2A Sensor/wiring open or short circuit
04 — 2B Sensor/wiring open or short circuit
05 — 3A Sensor/wiring open or short circuit
06 — 3B Sensor/wiring open or short circuit
07 — System is O.K. vehicle is stationary
08 — Retarder / Wiring open circuit
09 — Retarder / Wiring short circuit
OA — Reset to ride / Wiring open circuit
OC — Reset to ride / Wiring short circuit
OE — Warning lamp circuit fault

LOW SENSOR OUTPUT GROUP

11 — 1A Sensor system fault
12 — 1B Sensor system fault
13 — 2A Sensor system fault
14 — 2B Sensor system fault
15 — 3A Sensor system fault
16 — 3B Sensor system fault
Possible causes:
Sensor worn, maladjusted sensor, wiring open or short circuit.

20 — Incorrect exciter type.
Possible causes:
Exciter tooth count difrent each side of axle.

INTERMITTENT LOW SENSOR OUTPUT GROUP

21 — 1A Sensor system fault
22 — 1B Sensor system fault
23 — 2A Sensor system fault
24 — 2B Sensor system fault
25 — 3A Sensor system fault
26 — 3B Sensor system fault
Possible causes:
Loose sensor, connection, bracket or exciter.Damaged exciter.
Maladjusted sensor or worn sensor cable insulation.

CODE DISPLAYED

37	Lamp signalled by external device
	ONE WHEEL WITH SLOW RECOVERY GROUP
40	Sensor wiring crossed across an axle
41	Slow recovery of one wheel of red channel
42	Slow recovery of one wheel of blue channel
43	Slow recovery of one wheel of yellow channel ***Possible causes:*** Slow brake release, foundation brake mechanical faults, dry bearings, broken spring, restricted piping Check for kinks and blockages etc. Incorrect piping, wiring, modulator fault
	OPEN CIRCUIT MODULATOR SOLENOID OR SOLENOID WIRING GROUP
61	Hold solenoid circuit fault, red channel
62	Hold solenoid circuit fault, blue channel
63	Hold solenoid circuit fault, yellow channel
67	Dump solenoid circuit fault, red channel
68	Dump solenoid circuit fault, blue channel
69	Dump solenoid circuit fault, yellow channel
	SHORT CIRCUIT ACROSS MODULATOR SOLENOID OR SOLENOID WIRING GROUP
71	Hold solenoid circuit fault, red channel
72	Hold solenoid circuit fault, blue channel
73	Hold solenoid circuit fault, yellow channel
77	Dump solenoid circuit fault, red channel
78	Dump solenoid circuit fault, blue channel
79	Dump solenoid circuit fault, yellow channel
	MODULATOR SOLENOID WIRING OR SOLENOID SHORT TO B+ GROUP
80	Poor insulation in the modulator solenoid or wiring fault
81	Hold solenoid circuit fault, red channel.
82	Hold solenoid circuit fault, blue channel
83	Hold solenoid circuit fault, yellow channel
87	Dump solenoid circuit fault, red channel
88	Dump solenoid circuit fault, blue channel
89	Dump solenoid circuit fault, yellow channel
	SUPPLY VOLTAGE GROUP
90	Supply voltage at ECU less than 18v when a solenoid is energised
91	Faulty supply from ISO 7638 Pin 1 or fuse blown
92	Supply voltage at the ECU greater than 32v

CODE DISPLAYED

93	Internal ECU fault
99	Internal ECU fault

SYSTEM FUNCTION GROUP

A1	Reset to ride height (COLAS)
A2	Retarder

CONFIGURATION CODES

Figures in brackets indicate sensing is disabled when the axle is lifted.

	Function	Axle Lifted	Sensors Used	Modulators Used
C0	2S/1M		1A, 1B	Red
C1	2S/2M		2A, 2B	Blue, Yellow
C2	4S/2M		2A, 2B, 3A, 3B	Blue, Yellow
C3	4S/2M	2 or 3	2A, 2B, (3A), (3B)	Blue, Yellow

SUNDRY ADDITIONAL CODES

CA	Erase stored fault
CC	Clear Configuration
CF	Sensors and Solenoid not connected CF may alternate with code 90 meaning low voltage. See code 90 for diagnosis.
LO or HI	Communication failure between ECU and DDU, open or short circuit wiring

11.0 DIAGNOSTIC UTILITIES

11.1 PC Interface Kit

The PC interface Kit is comprised of the Interface 1 Pod, together with its connecting cables and a transit case. The kit permits the connection of the diagnostic port of the ABS controller to a serial port on a PC.
The pod is provided with three LEDs to confirm correct functioning of the units as follows:

Red: To indicate that 24V Power is connected.

Yellow: To indicate data is being transmitted by the PC.

Green: To indicate data is being transmitted by the ABS ECU.

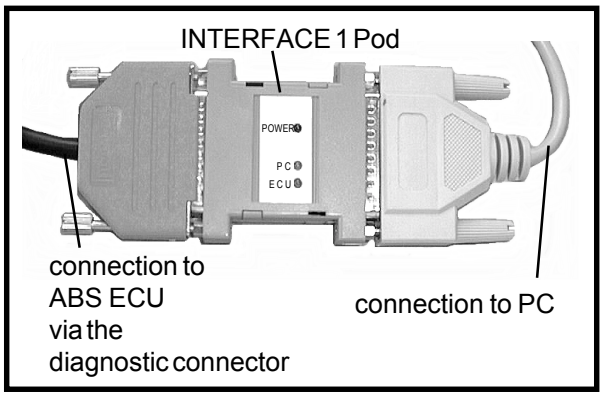


Fig 11.1 INTERFACE 1 POD

This kit provides the interface required by the two communication packages: Vehicle Data System (VDS) and End-of-Line Test (EOLT).

11.2 Vehicle Data System (VDS)
VDS offers the ability to capture operational data from the ABS ECU and to store it on a PC. It is then possible to manipulate the data using common PC spreadsheets.
The data stored in the ECU is divided into two sections. The first section is data recorded by the ABS ECU during trailer highway operation and includes ABS system status and vehicle mileage. The second is information created by the user for example service and maintenance records, such as information related to the treatment of specific loads, tyre wear statistics or other details that would be useful to your business.
This data is stored inside the ABS ECU and will remain intact even after electrical power is removed from the trailer.

Supplied with the VDS software package, are sample spreadsheet templates that show examples of information that can be collected and stored in your VDS system.
You can also create your own templates and macros that will enable you to store information specific to your business.

Full details of the VDS package are available in a separate publication.

11.3 End-of-Line Test (EOLT)
EOLT offers the ability to execute tests on all of the Modular and Modal ABS products. This is achieved by collection and storing two types of data from the ABS system. The first type is test data recorded by the ABS system, example wheel speeds as measured on a rolling road and system configuration data. The second type is data entered by the user.

Full details of the EOLT package are available in a seperate publication.

11.4 Minimum system specifications:
The minimum PC or Laptop specification to run either of the diagnostic packages is as follows:

MS-DOS :
- PC-AT or compatible.
- RAM - 640K
- Hard Drive - 1Mb Free
- Monitor - EGA / VGA

MS Windows 3.11 or 3.1:
- Processor - 286 or above
- RAM - 4 Megabytes (8 recommended)
- Hard Drive - 20 Megabytes
- Monitor - EGA / VGA

MS Windows 95:
- Processor - 486 or above
- RAM - 8 Megabytes (16 recommended)
- Hard Drive - 20 Megabytes
- Monitor - EGA / VGA

In addition to the above, a 3.5" diskette drive is required for software installation and a vacant serial port will be required to connect to the interface 1 pod.

12.0 SYSTEM WIRING DIAGRAMS

12.1 WIRING REPAIRS

1.Before undertaking maintenance or repairs on a the MODULAR ABS system it is necessary to understand the system configuration of the vehicle being worked upon. (see section 8.0)

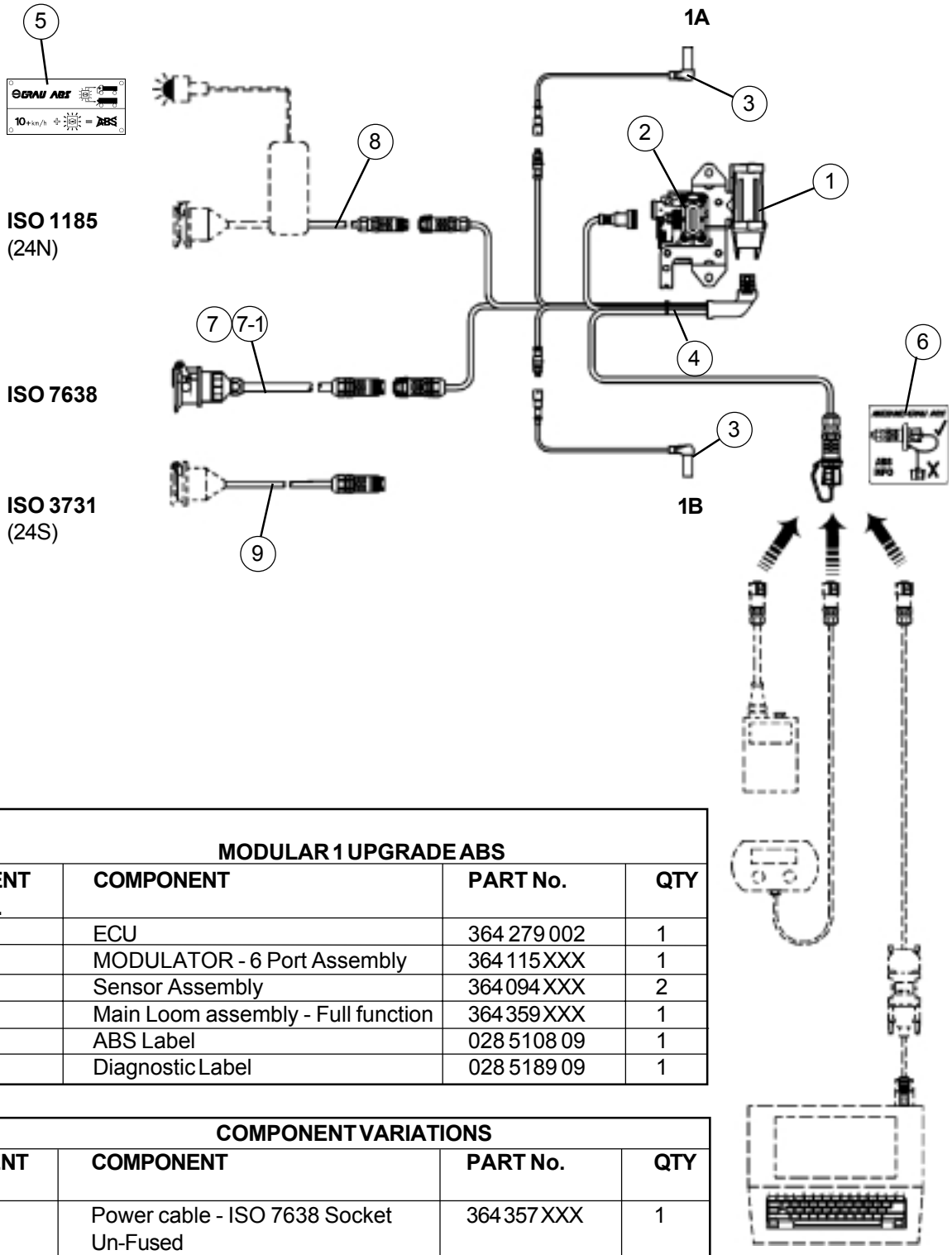
2.First read section 8.0 configurations and determine the wiring diagram to suit your vehicle.

3.Proceed with maintenance and repairs accordingly using the appropriate wiring diagram.

4.To maintain system reliability wiring repairs must be of a high standard. The ECU relies upon receiving low voltage signals from the sensors via cables and connectors which should offer minimal electrical resistance. It is particularly important therefore that the recommended cable, connectors and tools are used to ensure as low a resistance as possible. All electrical connections must be made as shown in the relevant wiring diagrams.

IMPORTANT: FAILURE TO OBSERVE THESE RECOMMENDATIONS MAY LEAD TO A SYSTEM MALFUNCTION.

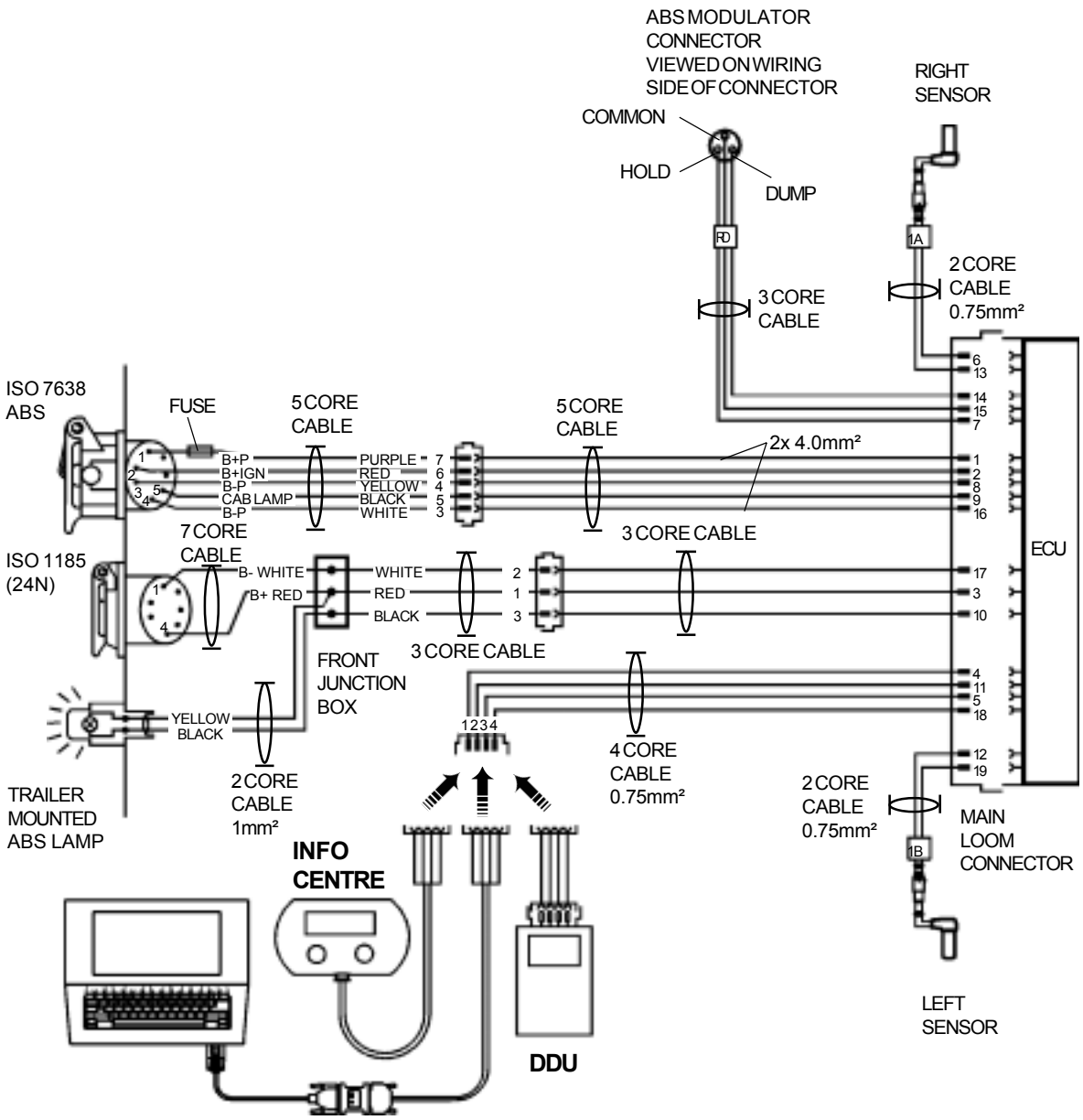
MODULAR 1 UPGRADE



MODULAR 1 UPGRADE ABS			
IDENT No.	**COMPONENT**	**PART No.**	**QTY**
1	ECU	364 279 002	1
2	MODULATOR - 6 Port Assembly	364 115 XXX	1
3	Sensor Assembly	364 094 XXX	2
4	Main Loom assembly - Full function	364 359 XXX	1
5	ABS Label	028 5108 09	1
6	Diagnostic Label	028 5189 09	1

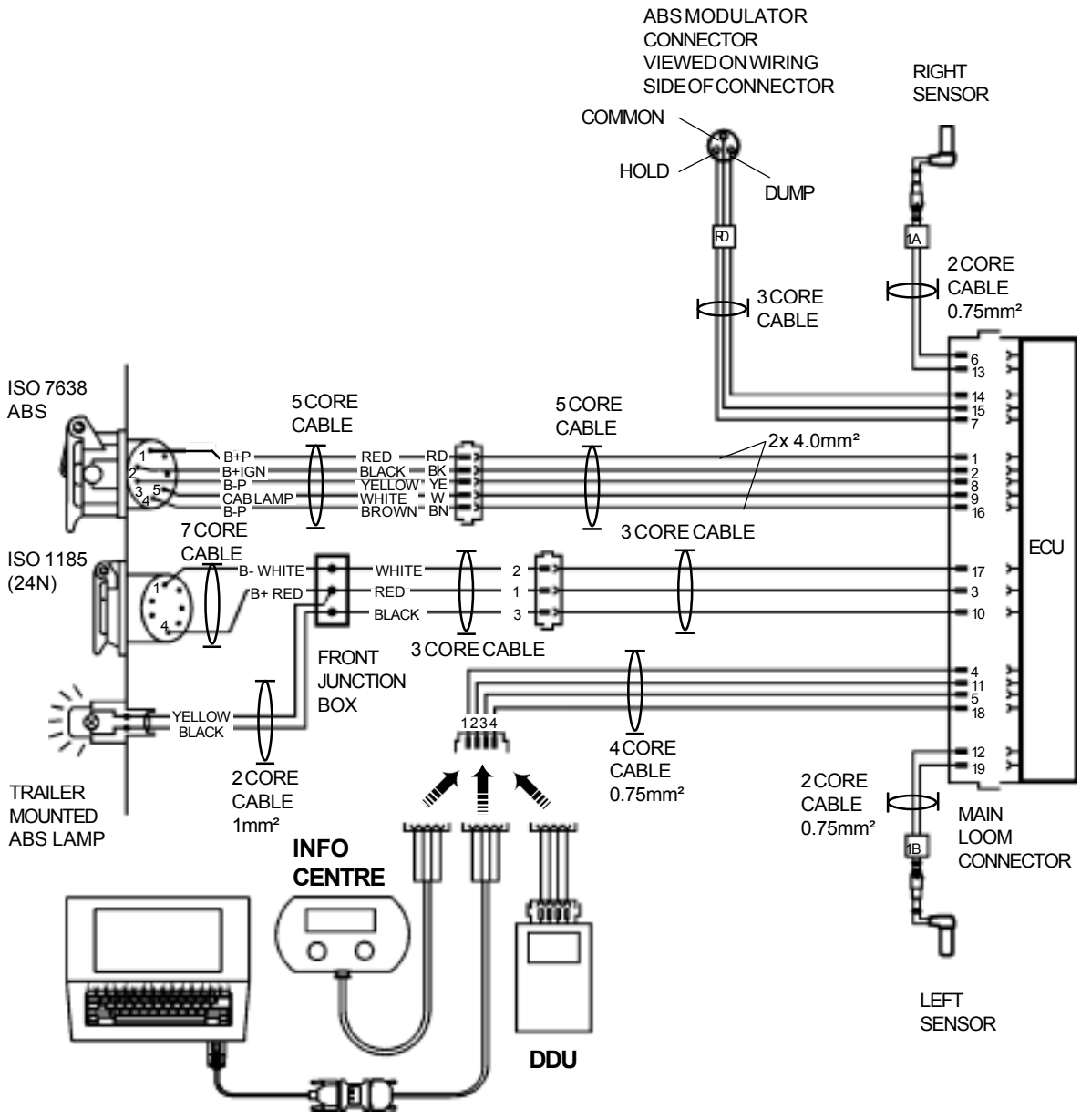
COMPONENT VARIATIONS			
IDENT No.	**COMPONENT**	**PART No.**	**QTY**
7	Power cable - ISO 7638 Socket Un-Fused	364 357 XXX	1
7-1	Power cable - ISO 7638 Socket Fused	364 362 XXX	1
8	ISO 1185 (24N) Cable assembly PVC	364 370 XXX	1
9	ISO 3731 (24S) Cable assembly PVC	364 373 XXX	1

Fig 12.1 **MODULAR 1 UPGRADE** WIRING VARIATIONS FOR SEMI TRAILER AND CENTRE AXLE.



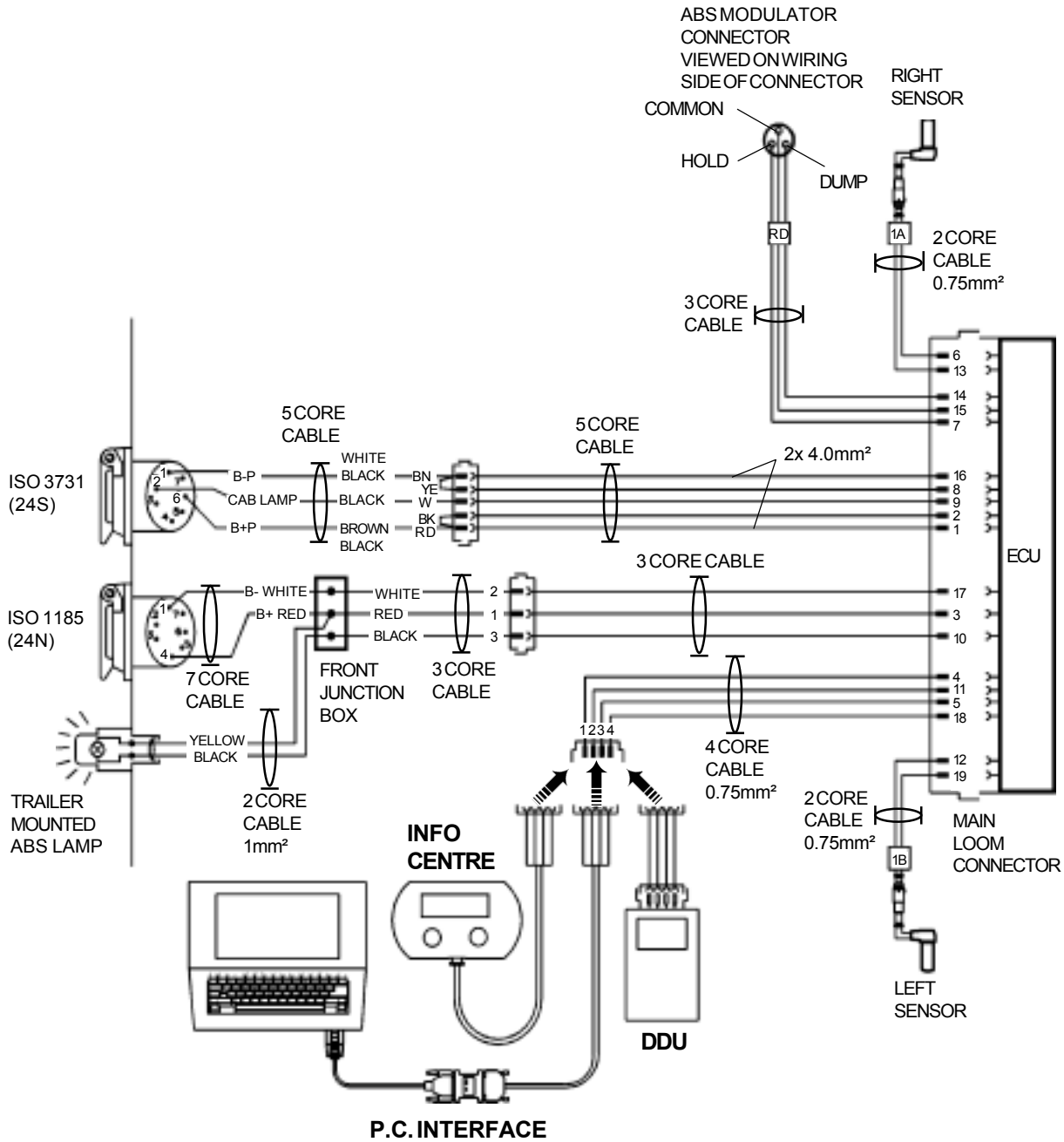
LEGEND	
N 1	The wheel speed sensors will be fitted to one axle only.
N 2	All wires are 1.5mm² unless specified.
N 3	Sensor cables to go to the left and right hand wheels of the sensed axle. Left and Right hand is as if sat in the driver's seat facing forward.
N 4	The maximum cable length between ISO 1185 (24N) connector and the front junction box is 1metre.

Fig 12.2 **MODULAR 1 UPGRADE** WIRING DIAGRAM ISO 7638 (FUSED) AND ISO 1185 (24N) POWER SUPPLY



LEGEND	
N 1	The wheel speed sensors will be fitted to one axle only.
N 2	All wires are 1.5mm² unless specified.
N 3	Sensor cables to go to the left and right hand wheels of the sensed axle. Left and Right hand is as if sat in the driver's seat facing forward.
N 4	The maximum cable length between ISO 1185 (24N) connector and the front junction box is 1metre.

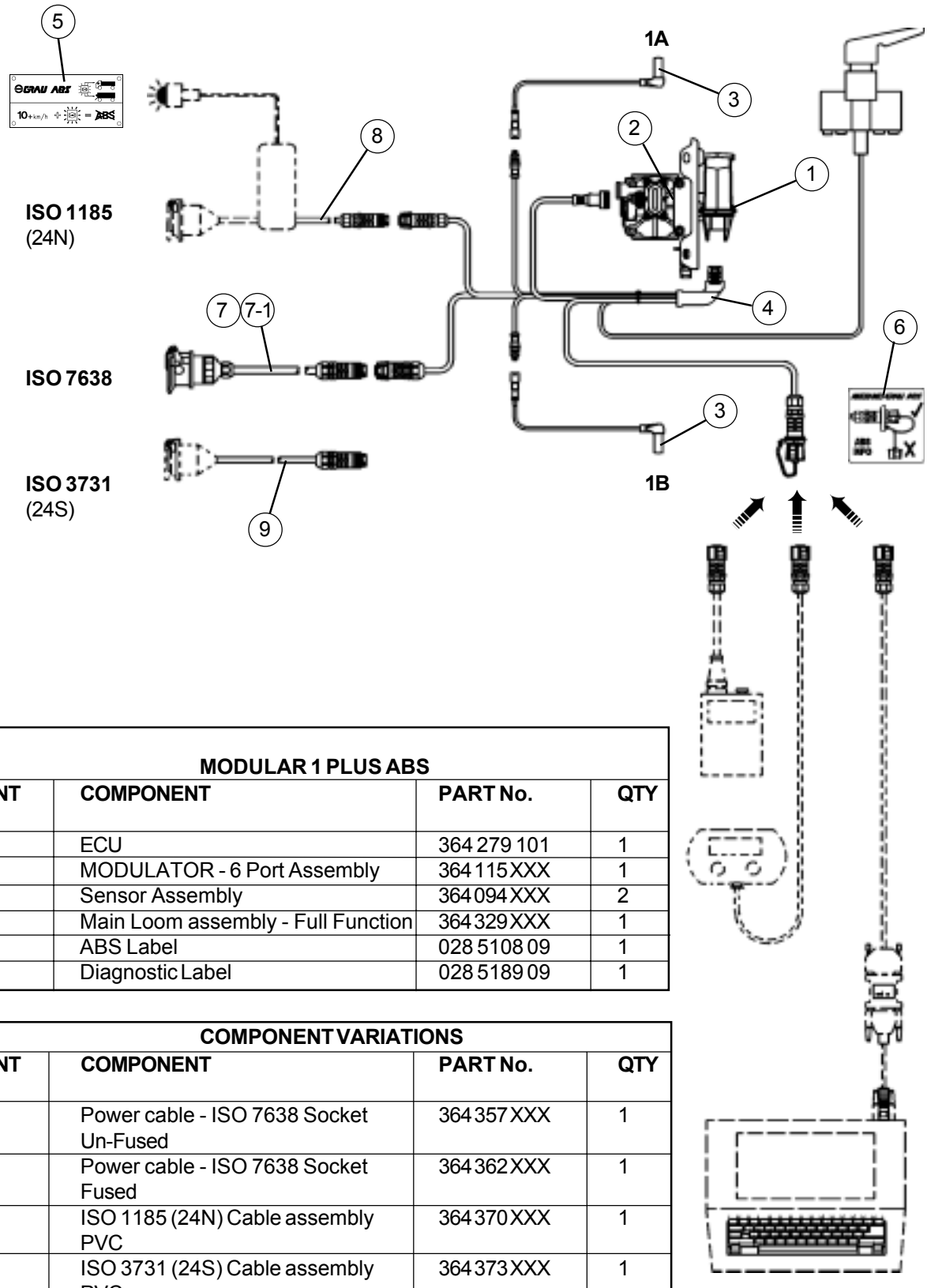
Fig 12.3 **MODULAR 1 UPGRADE** WIRING DIAGRAM ISO 7638 (UNFUSED) AND ISO 1185 (24N) POWER SUPPLY



LEGEND	
N 1	The wheel speed sensors will be fitted to one axle only.
N 2	All wires are 1.5mm² unless specified.
N 3	Sensor cables to go to the left and right hand wheels of the sensed axle. Left and Right hand is as if sat in the driver's seat facing forward.
N 4	The maximum cable length between ISO 1185 (24N) connector and the front junction box is 1metre.

Fig 12.4 **MODULAR 1 UPGRADE** WIRING DIAGRAM ISO 3731 (24S) AND ISO 1185 (24N) POWER

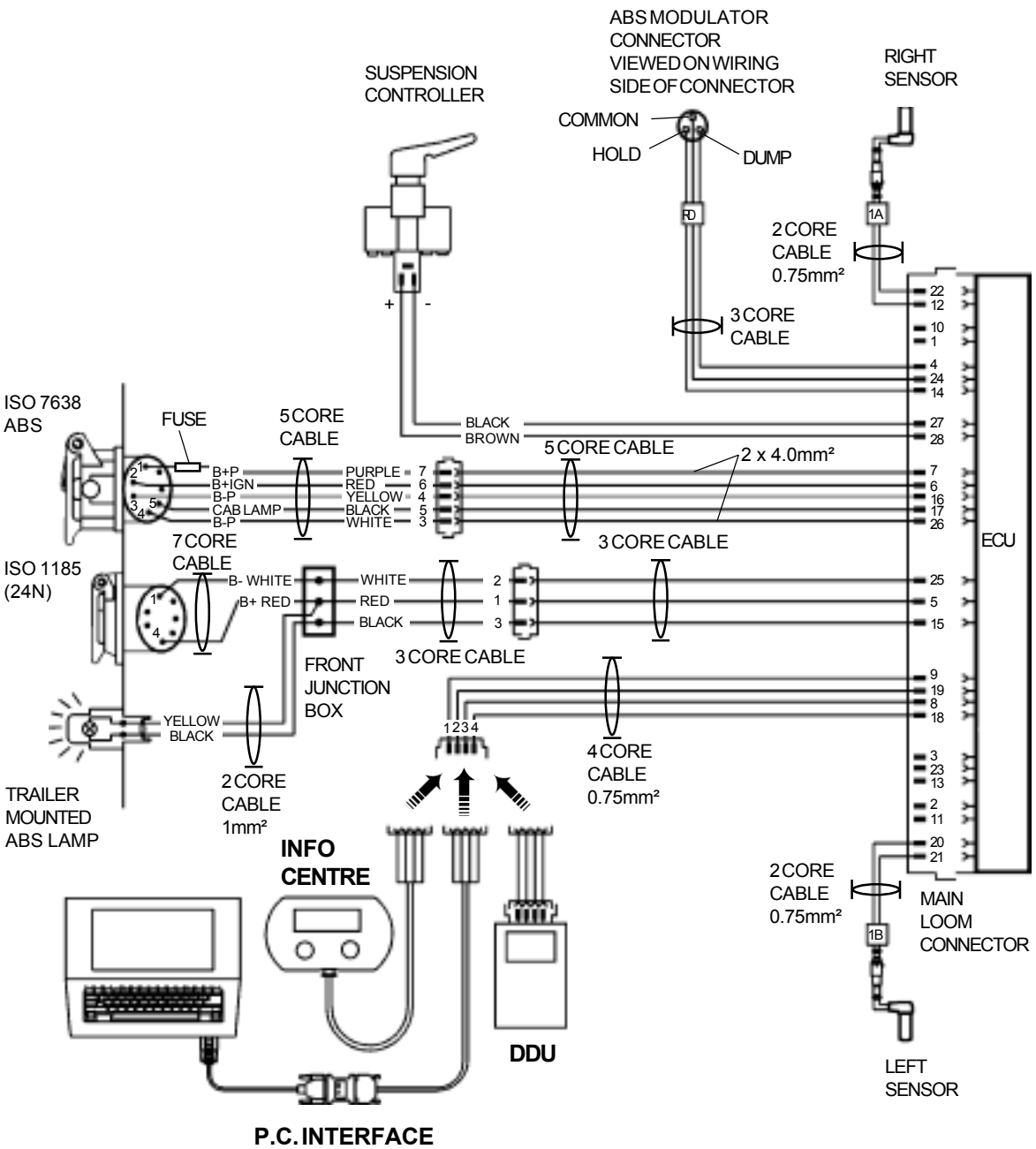
MODULAR 1 PLUS



MODULAR 1 PLUS ABS			
IDENT No.	**COMPONENT**	**PART No.**	**QTY**
1	ECU	364 279 101	1
2	MODULATOR - 6 Port Assembly	364 115 XXX	1
3	Sensor Assembly	364 094 XXX	2
4	Main Loom assembly - Full Function	364 329 XXX	1
5	ABS Label	028 5108 09	1
6	Diagnostic Label	028 5189 09	1

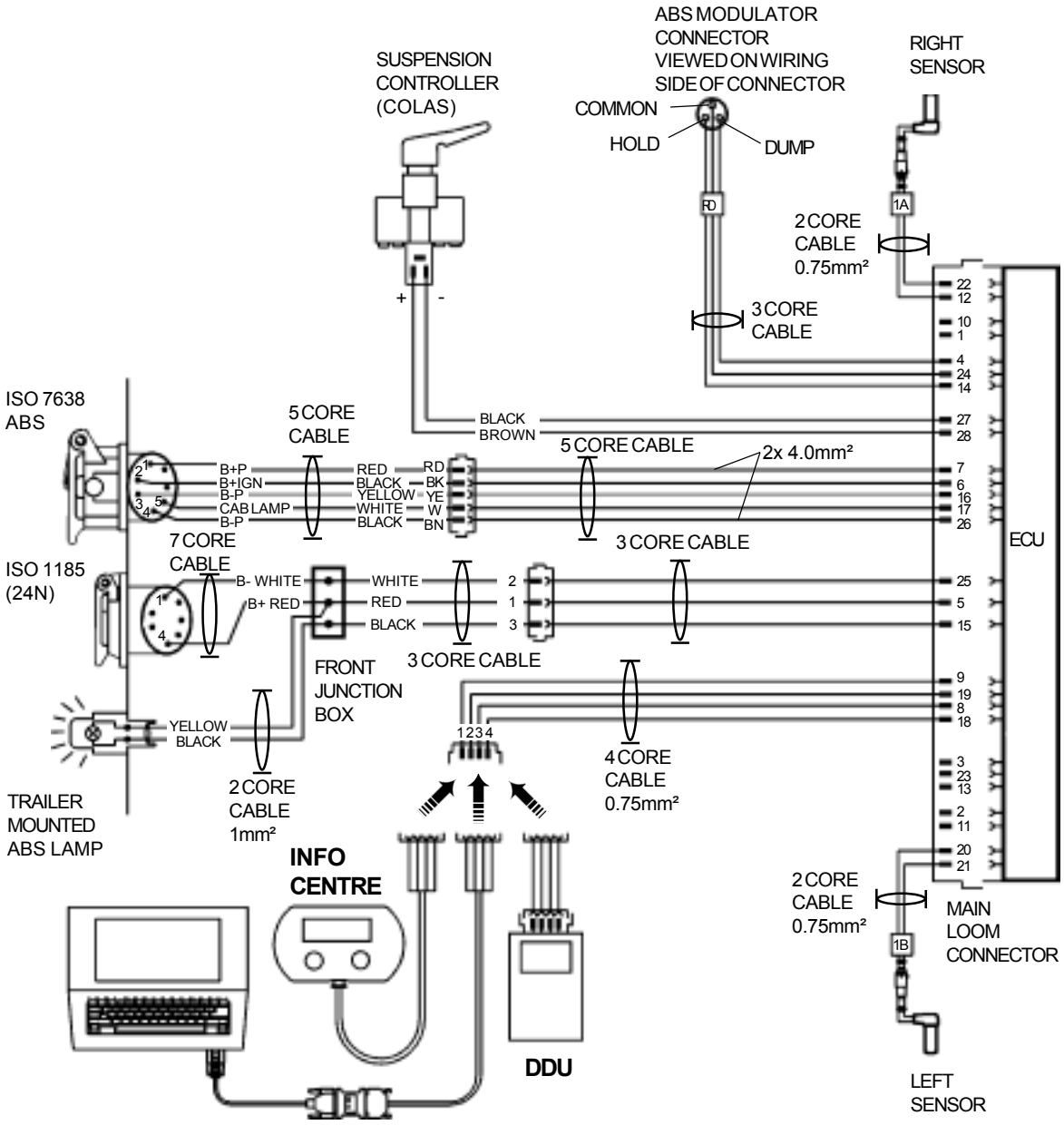
COMPONENT VARIATIONS			
IDENT No.	**COMPONENT**	**PART No.**	**QTY**
7	Power cable - ISO 7638 Socket Un-Fused	364 357 XXX	1
7-1	Power cable - ISO 7638 Socket Fused	364 362 XXX	1
8	ISO 1185 (24N) Cable assembly PVC	364 370 XXX	1
9	ISO 3731 (24S) Cable assembly PVC	364 373 XXX	1

Fig 12.5 **MODULAR 1 PLUS** WIRING VARIATIONS FOR SEMI TRAILER AND CENTRE AXLE.



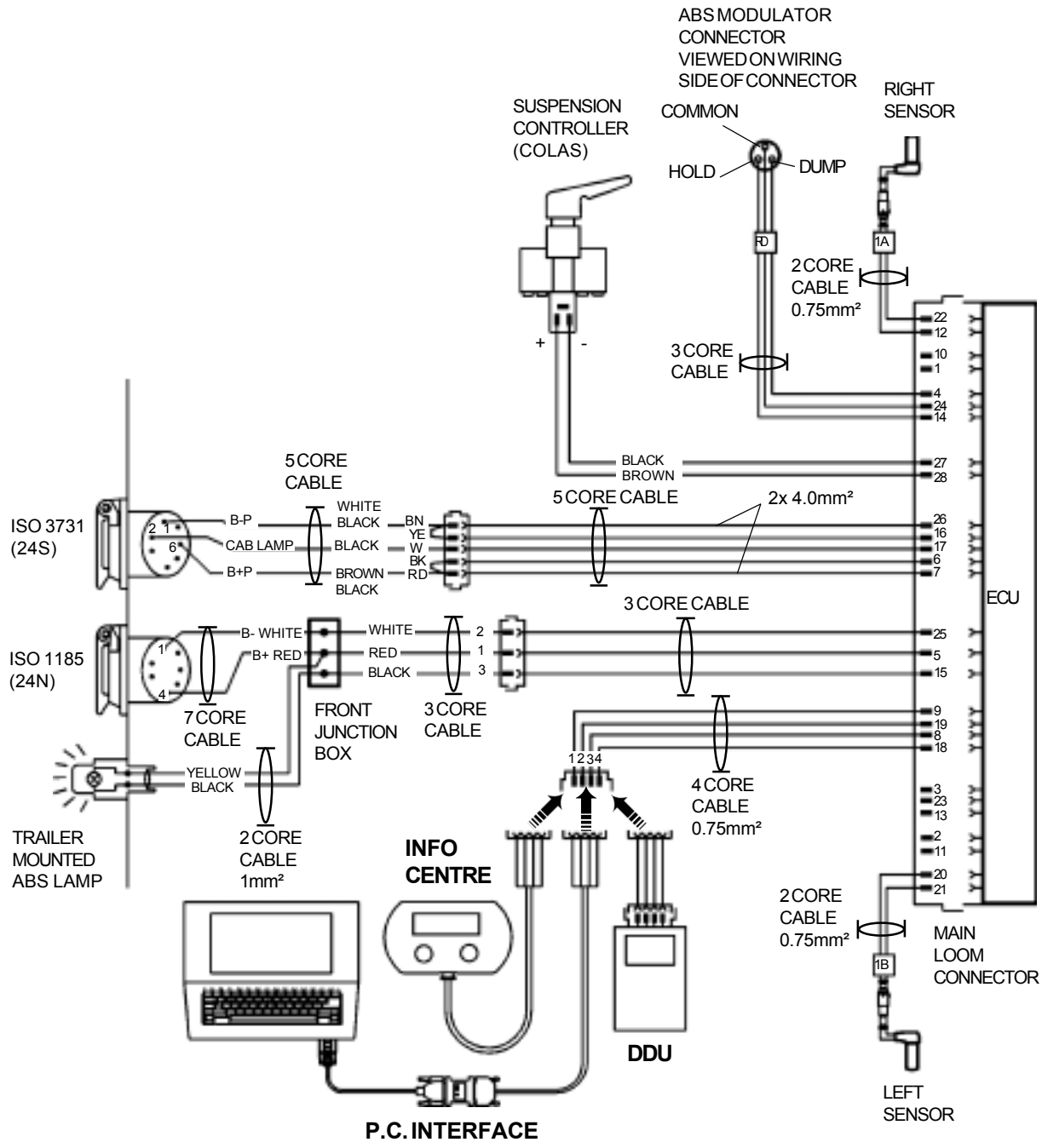
LEGEND	
N 1	The wheel speed sensors will be fitted to one axle only.
N 2	All wires are 1.5mm² unless specified.
N 3	Sensor cables to go to the left and right hand wheels of the sensed axle. Left and Right hand is as if sat in the driver's seat facing forward.
N 4	The maximum cable length between ISO 1185 (24N) connector and the front junction box is 1metre.

Fig 12.6 **MODULAR 1 PLUS** WIRING DIAGRAM ISO 7638 (FUSED) AND ISO 1185 (24N) POWER SUPPLY



LEGEND	
N 1	The wheel speed sensors will be fitted to one axle only.
N 2	All wires are 1.5mm² unless specified.
N 3	Sensor cables to go to the left and right hand wheels of the sensed axle. Left and Right hand is as if sat in the driver's seat facing forward.
N 4	The maximum cable length between ISO 1185 (24N) connector and the front junction box is 1metre.

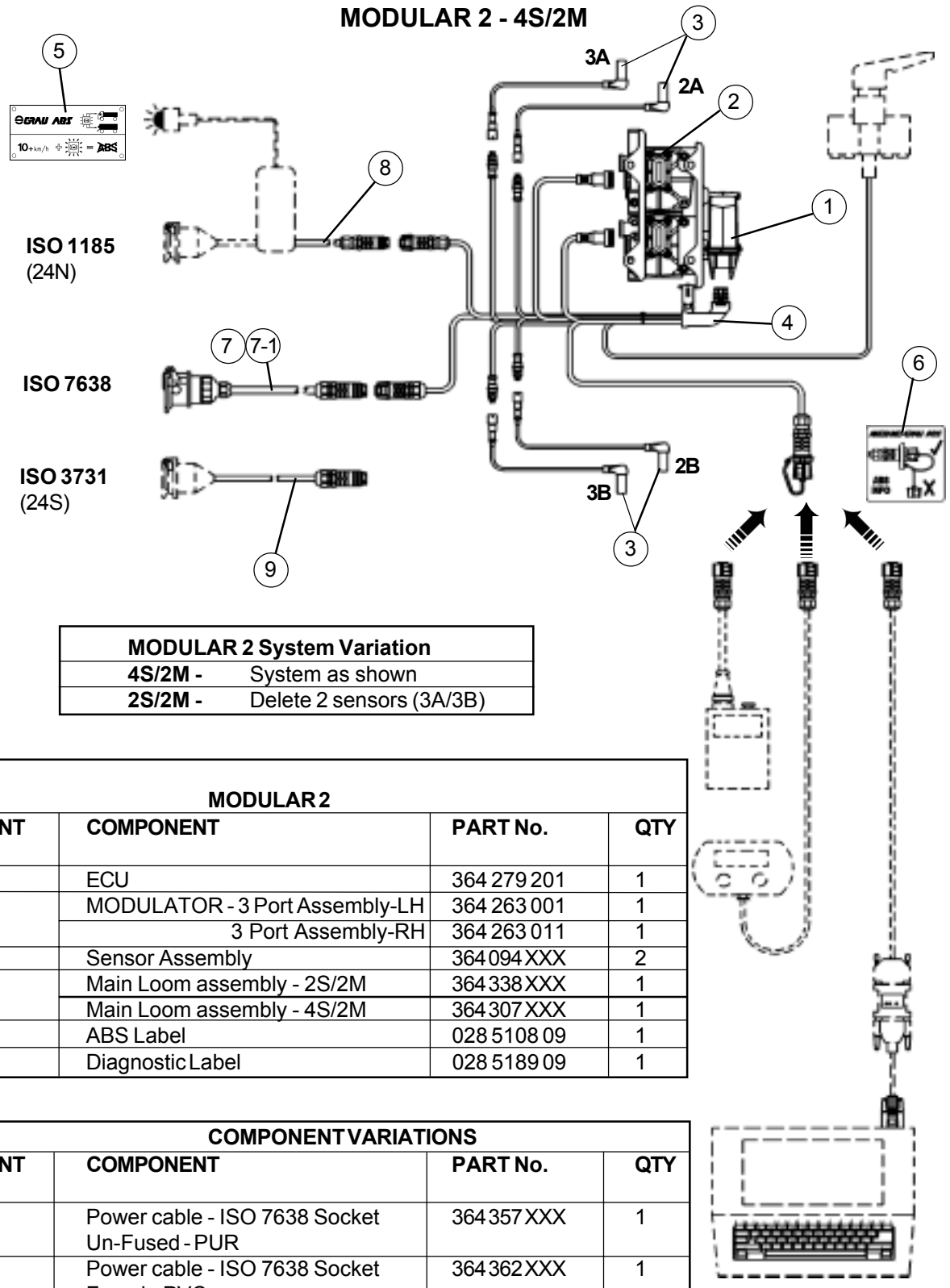
Fig 12.7 **MODULAR 1 PLUS** WIRING DIAGRAM ISO 7638 (UNFUSED) AND ISO 1185 (24N) POWER SUPPLY



LEGEND	
N 1	The wheel speed sensors will be fitted to one axle only.
N 2	All wires are 1.5mm² unless specified.
N 3	Sensor cables to go to the left and right hand wheels of the sensed axle. Left and Right hand is as if sat in the driver's seat facing forward.
N 4	The maximum cable length between ISO 1185 (24N) connector and the front junction box is 1metre.

Fig 12.8 **MODULAR 1 PLUS** WIRING DIAGRAM ISO 3731 (24S) AND ISO 1185 (24N) POWER

MODULAR 2 - 4S/2M

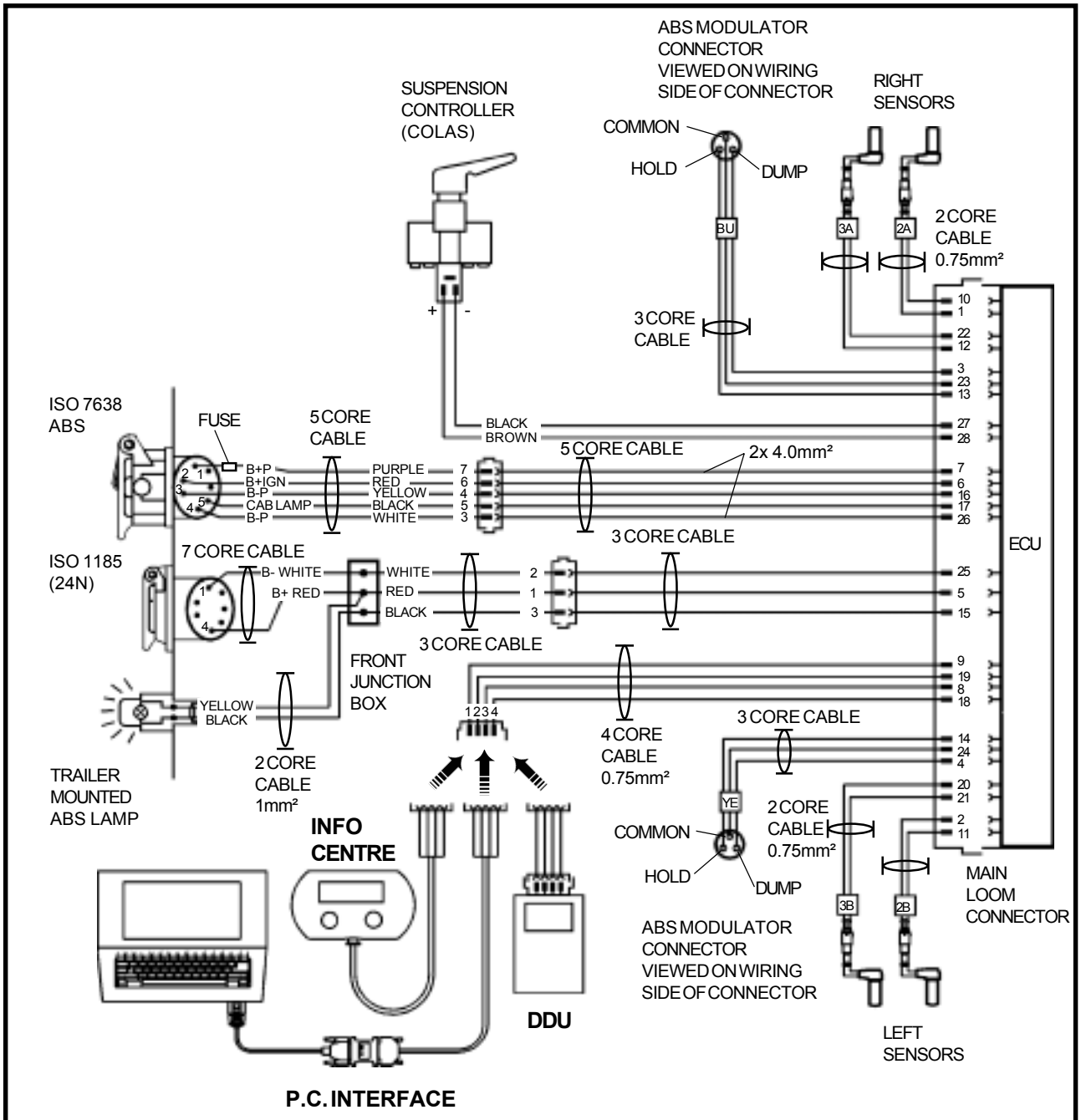


MODULAR 2 System Variation	
4S/2M -	System as shown
2S/2M -	Delete 2 sensors (3A/3B)

MODULAR 2			
IDENT No.	**COMPONENT**	**PART No.**	**QTY**
1	ECU	364 279 201	1
2	MODULATOR - 3 Port Assembly-LH	364 263 001	1
	3 Port Assembly-RH	364 263 011	1
3	Sensor Assembly	364 094 XXX	2
4	Main Loom assembly - 2S/2M	364 338 XXX	1
	Main Loom assembly - 4S/2M	364 307 XXX	1
5	ABS Label	028 5108 09	1
6	Diagnostic Label	028 5189 09	1

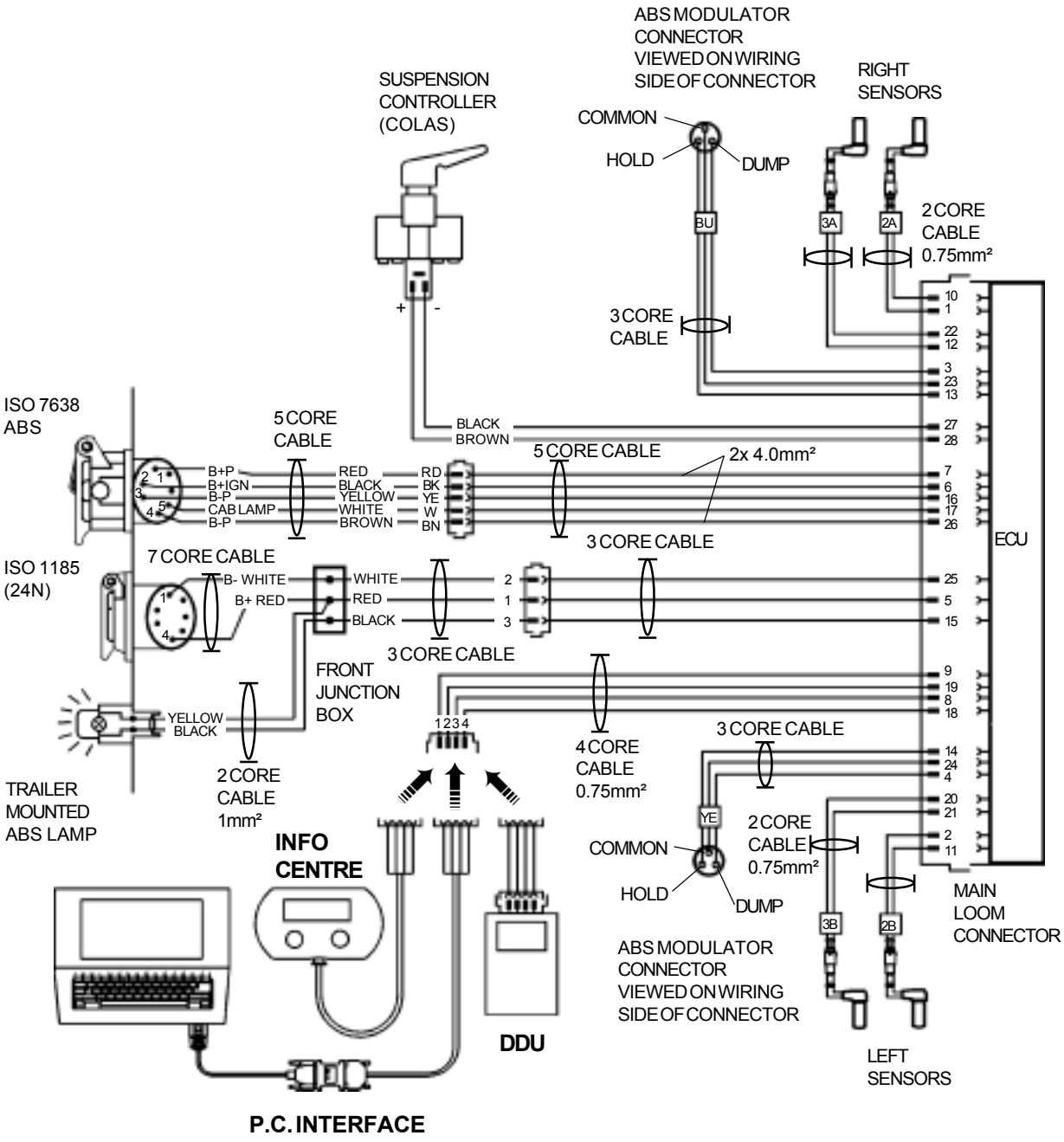
COMPONENT VARIATIONS			
IDENT No.	**COMPONENT**	**PART No.**	**QTY**
7	Power cable - ISO 7638 Socket Un-Fused - PUR	364 357 XXX	1
7-1	Power cable - ISO 7638 Socket Fused - PVC	364 362 XXX	1
8	ISO 1185 (24N) Cable assembly PUR	364 358 XXX	1
9	ISO 3731 (24S) Cable assembly PUR	364 373 XXX	1

Fig 12.9 **MODULAR 2 - 4S/2M** WIRING VARIATIONS FOR SEMI TRAILER AND CENTRE



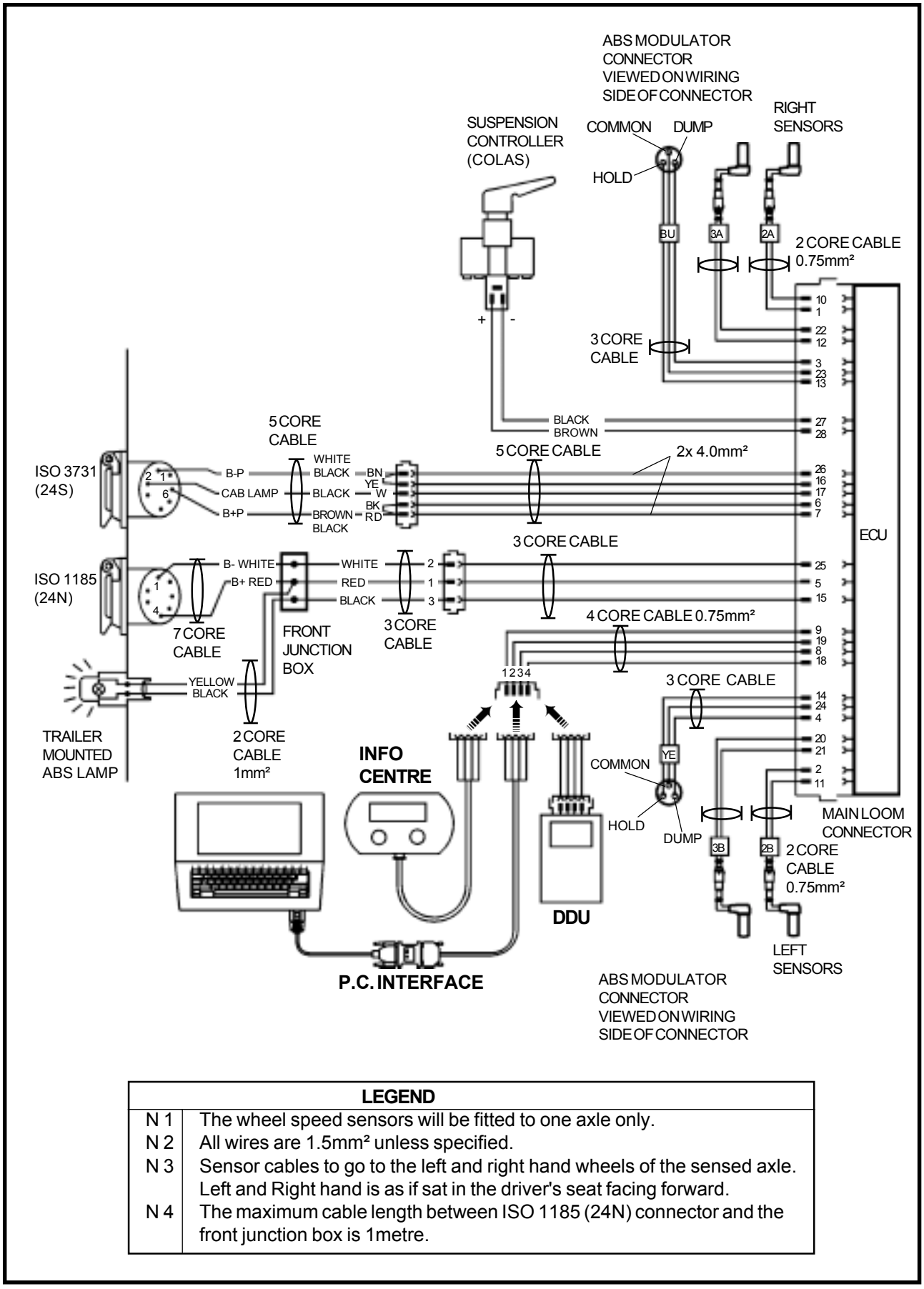
LEGEND	
N 1	The wheel speed sensors will be fitted to one axle only.
N 2	All wires are 1.5mm² unless specified.
N 3	Sensor cables to go to the left and right hand wheels of the sensed axle. Left and Right hand is as if sat in the driver's seat facing forward.
N 4	The maximum cable length between ISO 1185 (24N) connector and the front junction box is 1metre.

Fig 12.10 **MODULAR 2 - 4S/2M** WIRING DIAGRAM ISO 7638 (FUSED) AND ISO 1185 (24N) POWER SUPPLY



LEGEND	
N 1	The wheel speed sensors will be fitted to one axle only.
N 2	All wires are 1.5mm² unless specified.
N 3	Sensor cables to go to the left and right hand wheels of the sensed axle. Left and Right hand is as if sat in the driver's seat facing forward.
N 4	The maximum cable length between ISO 1185 (24N) connector and the front junction box is 1metre.

Fig 12.11 **MODULAR 2 - 4S/2M** WIRING DIAGRAM ISO 7638 (UNFUSED) AND ISO 1185 (24N) POWER SUPPLY



LEGEND	
N 1	The wheel speed sensors will be fitted to one axle only.
N 2	All wires are 1.5mm² unless specified.
N 3	Sensor cables to go to the left and right hand wheels of the sensed axle. Left and Right hand is as if sat in the driver's seat facing forward.
N 4	The maximum cable length between ISO 1185 (24N) connector and the front junction box is 1metre.

Fig 12.12 **MODULAR 2 - 4S/2M** WIRING DIAGRAM ISO 3731 (24S) AND ISO 1185 (24N) POWER

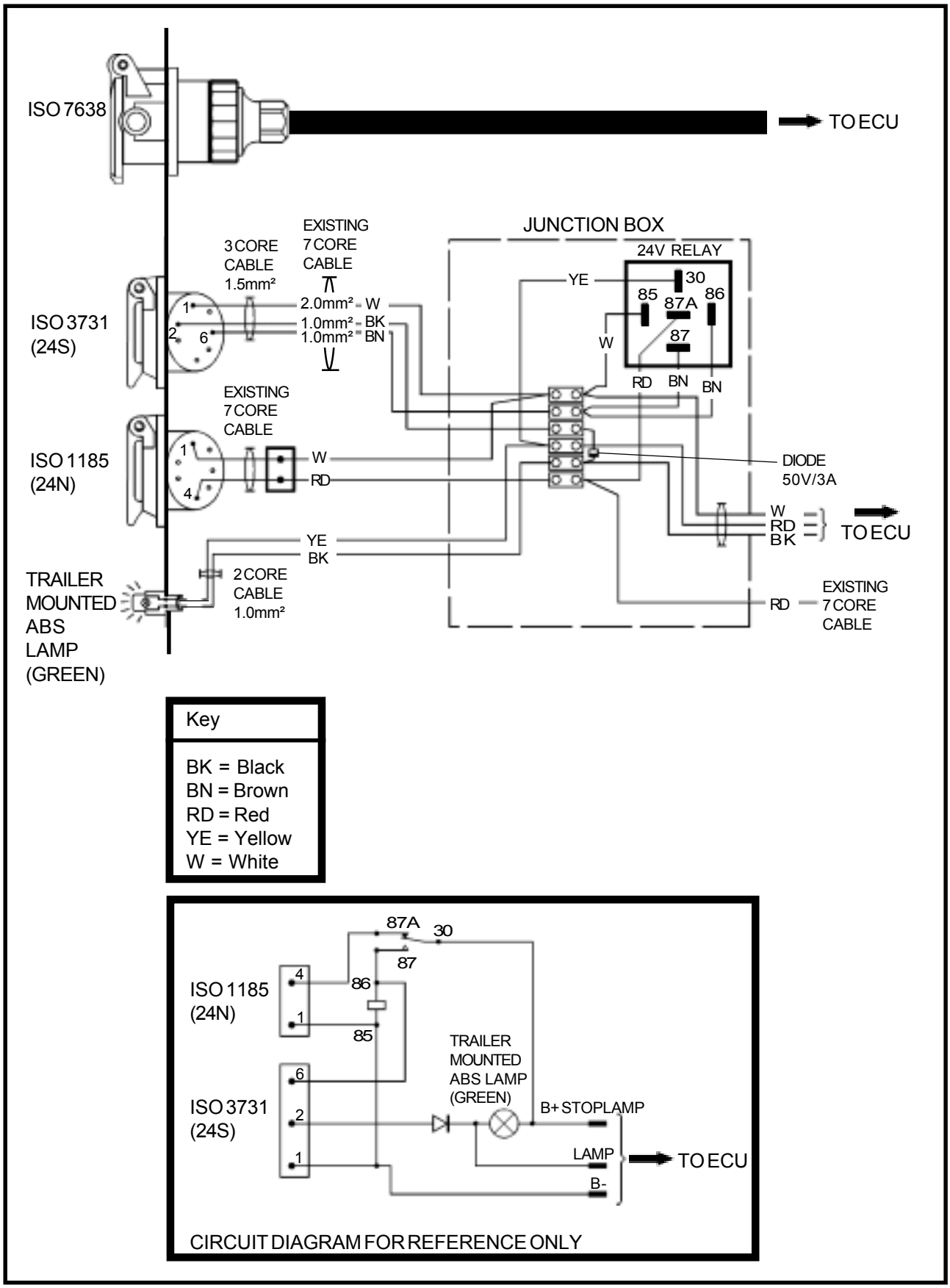


Fig 12.13 **MODULAR** 1M and 2M SYSTEMS WIRING DIAGRAM
ISO 3731 (24S), ISO 1185 (24N) AND ISO 7638 POWER SUPPLY

13.0 ROUTINE MAINTENANCE RECOMMENDATIONS

13.1 THE EXCITER
Refer to section 2.0

13.2 THE SENSOR
Refer to section 3.0.

13.3 THE ELECTRONIC CONTROL UNIT
The ECU requires no routine maintenance.

13.4 THE MODULATOR
Refer to section 5.0.

13.5 BRAKE SERVICING
Poor brake maintenance will affect the ABS system performance. Pay particular attention to seized cam shafts, expander assemblies, shoe return springs, oval drums and correct brake adjustment. When removing shoe assemblies avoid damaging the exciter, the sensor and its housing or cable. Always ensure that the sensor is correctly reset, after brake shoe replacement and prior to re-fitting the brake drum and wheel assemblies. (See section 3.4).

13.6 BRAKE PIPING
Before undertaking maintenance or repairs of a MODULAR ABS, it is necessary to understand the configuration because pipework will vary from one configuration to another (See section 8.0). Ensure that before stripping out pipework from modulator(s) and brake chambers that they are clearly marked for replacement into the same ports from which they were removed.

FAILURE TO OBSERVE THE CORRECT PIPING CONNECTIONS AS IN THE ORIGINAL INSTALLATION WILL RESULT IN POOR BRAKE AND ABS PERFORMANCE, WHICH MAY CAUSE THE ABS SYSTEM TO SWITCH OFF (Fault codes group 41, 42 or 43 see section 8.4).

Should it be necessary to change a pipe in the braking system it is essential that the replacement is the same type and has the same bore size as originally fitted. Ensure that the replacement piping conforms to the specified standard for Air Brake Systems. Nylon air tubing conforming to SAE J844d or DIN 73378 (Metric Sizes) is the only recommended tubing.
When replacing brake pipes or modulators ensure that the correct pipe to valve port connections are made as found before removal.

13.7 WHEEL BEARINGS
Incorrect adjustment may reduce sensor output sufficiently to put the ABS warning lamp on above 6 mph (10 km/h). When refitting hubs, pull the hub onto the stub axle using the bearing centre nut, this will avoid rocking the hub and so eliminate any possibility of accidentally knocking the sensor out of adjustment.

13.8 WELDING
It is essential that the battery is disconnected or the master switch turned off during electric welding. Disconnect the wiring between the tractor and the trailer.

13.9 ROLLER BRAKE TESTING
Roller brake testing is not affected by Haldex ABS and may be undertaken in the normal manner.

13.10 ROAD SPRING REPLACEMENT
Do not cut the sensor cable when changing a road spring. Always cut the cable ties around the 'U' bolts and then refit new cable ties after the replacement spring has been installed. Take care not to damage the sensor cable and ensure that when it is refitted it is not routed in such a manner as to place it under undue tensile loading.
When refitting cable ties place them at approximately 150mm apart and do not excessively overtighten them, especially along brake hose runs, as this may cause damage to the cable conductors. Remember that when the brakes are applied, the brake hose will expand and thus tighten the cable tie, causing excessive shearing forces to be imparted to the cable.

13.11 MAINTENANCE OF AIR SYSTEMS
Piping should be checked at regular intervals for damage or restrictions e.g. pinched or kinked.
Ensure that the air reservoirs are regularly drained as recommended by the vehicle manufacturer.
No liquids should be introduced into the air system except for anti-freeze compounds approved by the vehicle manufacturer.

13.12 ROUTINE MAINTENANCE SCHEDULE

Time or mileage (whichever occurs first)	Component	Operation	Section Number
When hubs are removed	Exciter	Check for damage	2.0
	Sensor	Check for wear clean and re-adjust	3.0
Every 3 months or 25,000 miles (40,000 km)	Complete system	Perform system check out and air leakage check	1.2 5.6 + 5.7 Fig.8.6 to 8.8 as applicable
Annually or every (100,000 miles (160,000 km)	Complete system	Perform system check out and air leakage check. Check wiring and piping security and integrity	1.2 5.6 + 5.7 Fig. 8.6 to 8.8 as applicable
	Sensor	Check for wear clean and re-adjust	3.0
Every five years 500,000 miles (800,000 km)	Modulator and Solenoid	Replace	5.0

Fig 13.1 RECOMMENDED MAINTENANCE SCHEDULE

14.0 FIELD SERVICE INFORMATION

14.1 SERVICE INFORMATION
In the event of requiring further assistance your local area Installation or Service centre will be able to provide valuable help.
A list of these centres is to be found in Sections 14.7 to 14.9. A more comprehensive guide, which includes service agencies throughout Mainland Europe is available from
Haldex Brake Products Ltd at the address in section 15.6.

14.2 TELEPHONE SUPPORT
Haldex Brake Products Ltd provide in depth technical assistance and advice via the Redditch Head office, when telephoning please ask for Technical Service Dept.
Telephone: 01527 499 600
Fax: 01527 499 576

14.3 ENGINEER'S CALLS
Should it be necessary arrangements can be made for a Haldex Brake Products Ltd Field Service Engineer to provide on site assistance at a nominal charge. Contact details are as 14.2 above.

14.4 AGENCY SUPPORT AND DEFINITIONS
Haldex Brake Products Ltd employ the services of agencies throughout the UK to act on their behalf in providing localised service to customers using Haldex ABS. These agencies fall into four categories as follows:

INSTALLATION CENTRES - These agencies provide a complete service to the customer including primary installation of Haldex Brake Products Ltd ABS, service and repair of existing systems, and component part retail sales to the end user.

SERVICE CENTRES - Provide a service and repair function for existing Haldex Brake Products Ltd ABS systems and also component part retail sales. (See section 14.7)

PARTS DISTRIBUTORS - Provide retail sales of all component parts relating to Haldex Brake Products Ltd ABS systems. (See Section 14.8).

TRAILER PARTS DISTRIBUTORS ONLY
Stockist and retail sales of component parts specifically relating to trailers equipped with the MODULAR series of equipment.(See Section 14.8 e.g. Crane Fruehauf).
Crane Fruehauf also provide a repair service from a majority of depots which are also listed in the Crane Fruehauf service guide.

14.5 SERVICE EQUIPMENT
1. Available from all Haldex Brake Products Ltd installation, service, and parts centres listed on the previous pages.

2. MULTIMETER
METRIX MX570

3. TEST SWITCH BOX
May be used as an alternative to a towing vehicle as a power switching facility. The switch box is not supplied by Haldex but can be constructed easily using the circuit diagram Fig 10.1.

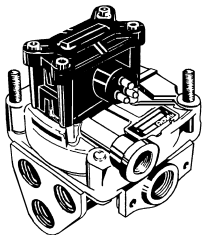
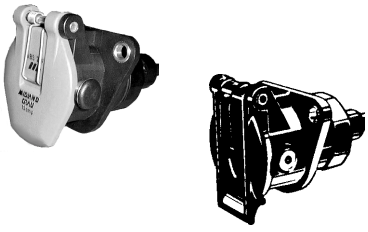
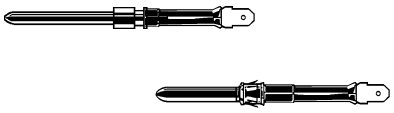
4. SUNDRY ITEMS
Trolley Jack
Axle stands
8mm Hexagonal key spanner
5mm Hexagonal key spanner
3mm Hexagonal key spanner
2 X Male blade terminals (6.35mm)
500 Volt insulation tester

14.6 SERVICE REPLACEMENT PARTS
Service replacement parts are available from all agents listed from section 14.7 through to section 14.8 or in the case of International Operations from the offices listed in section 14.9.

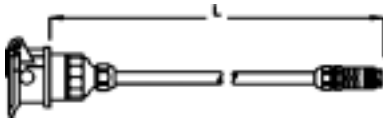
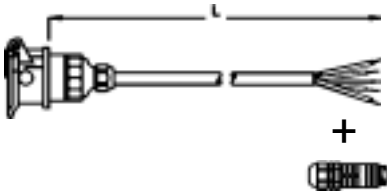
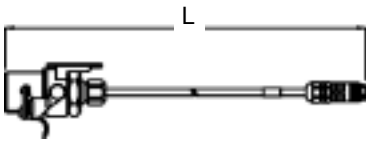
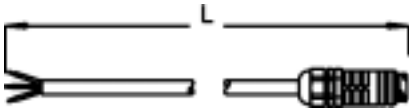
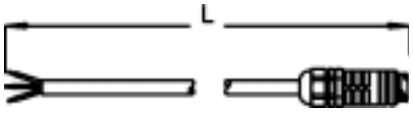
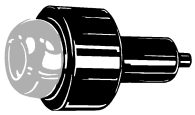
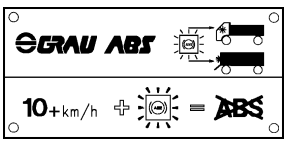
In order to assist you in determining the appropriate replacement component required, a selection of common spares is shown in the following listing.

MODULAR

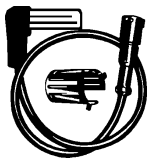
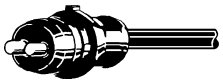
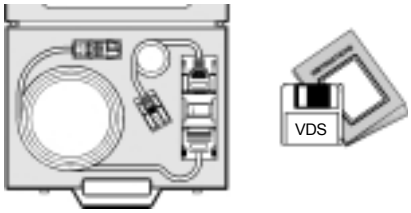
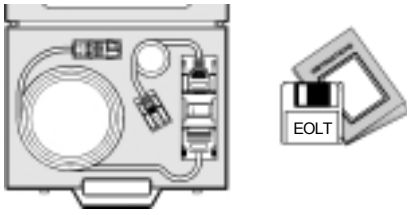
SERVICE PARTS

DESCRIPTION	PART NUMBER	VIEW
Electronic Control Unit MODULAR 1 Upgrade ECU - 364 279 002 MODULAR 1 Plus ECU - 364 279 101 MODULAR 2 ECU - 364 279 201 MODULAR 2 ADR ECU - 364 279 202	**950 364 801** **950 364 802** **950 364 803** **950 364 804**	
Modulator valve Assembly 6 Port - 364 115 021 3 Port - 364 263 001 - RH 3 Port - 364 263 011 - LH	**950 364 047** **950 364 806** **950 364 807**	
Manifold - for 2S-4S/2M systems	**950 364 075**	
ECU Loom Assembly MODULAR 1 Upgrade - 2S/1M c/w 4m Sensor ext. cables MODULAR 1 Plus - 2S/1M c/w 4m Sensor ext. cables and Reset to Ride MODULAR 2 - 2S/2M or 4S/2M c/w 4m + 6m Sensor ext. cables and Reset to Ride	 **950 364 417** **950 364 418** **950 364 419**	
ISO 7638 Socket Kit Green cover - c/w Fuse Black cover - w/o Fuse, crimp pins Red cover - w/o Fuse, screw pins	**950 364 072** **950 364 402** **950 364 420**	
Replacement fuse kit for fused ISO 7638	**950 364 401**	

MODULAR

DESCRIPTION	PART NUMBER	VIEW
ISO 7638 Socket and cable Assy. Fused - L = 12m - PVC Unfused - L = 12m - PUR	**950 364 421** **950 364 422**	
ISO 7638 Socket / cable + seprate connector Fused - L = 12m - PVC Unfused - L = 12m - PUR	**950 364 423** **950 364 424**	
ISO 7638 Plug and cable Assy. L = 12m - PVC	**950 364 429**	
ISO 1185 (24N) Cable Assemsbly *For MODULAR 1 Upgrade and Plus* L = 12m - PVC *For MODULAR 2* L = 12m - PUR	**950 364 425** **950 364 426**	
ISO 3731 (24S) Cable Assemsbly (All systems) L = 12m - PVC L = 12m - PUR	**950 364 427** **950 364 428**	
Green Warning Lamp	**950 364 710**	
Bulb - (24v - 5w) Double pole	**950 364 711**	
ABS Label	**950 364 702**	
Diagnostic Connector Label	**028 5189 09**	

MODULAR

DESCRIPTION	PART NUMBER	VIEW
Exciter ROR TM 100 Tooth 80 Tooth ROR TE 100 Tooth BPW-9T 100 Tooth BPW-10T 100 Tooth	 **018 5003 09** **018 5004 09** **018 5005 09** **950 364 606** **950 364 607**	
Sensor Kit - Angled (inc. retaining clip) Sensor Kit - Straight (inc. retaining clip)	**950 364 503** **950 364 506**	
Sensor extension cable repair kit (6.0m cable)	**950 364 507**	
Diagnostic Display Unit (DDU) c/w case and guide 2m Cable only 24m Cable only Case only	**905 027 001** **003 8467 09** **003 8433 09** **042 5074 09**	
INFO Centre 1.2m Cable 0.4m Cable 1.2m Cable - ADR Version 0.4m Cable - ADR Version	 **364 317 001** **364 317 011** **364 385 001** **364 385 011**	
Vehicle Data System Kit c/w Instruction Manual w/o Instruction Manual	**950 364 812** **950 364 814**	
'End-of-Line' Test Kit c/w Instruction Manual w/o Instruction Manual	**950 364 813** **950 364 815**	

Haldex Brake Systems

14.7 SERVICE CENTRES

Antilock Brake Systems Ltd
Sutton Coldfield
West Midlands
Tel: 0121 354 2856

B & T Services
Honeybourne
Tel: 01386 841021

H. Bowers Ltd
Stoke-on-Trent
Tel: 01782 599990

Button Repairs & Tpt. Services
Ipswich
Tel: 01473 612750

Cahil Motor Engineering
Newtownabby
Tel: 0232 853094

Chassis Developments Ltd
Leighton Buzzard
Tel: 01525 374151

Cumbria Auto Electrics Ltd
Carlisle
Tel: 0228 31707

CVBS Ltd
Brierley Hill
West Midlands
Tel: 0403 464 765

Dennison Commercial Ltd
Ballyclare
Tel: 019 603 52827

Hi-Power
Tallagh
Tel: 0001 525899

Husk (UK) Ltd
Dover
Tel: 0304 831222

Longfield Road Motors Ltd
Newcastle-upon-Tyne
Tel: 0191 2687648

Lucas Services UK Ltd
Southampton
Tel: 01703 777111

MacKenzies (Cambuslang) Ltd
Glasgow
Tel: 0141 641 6419504

H & F Moir
Aberdeen
Tel: 01224 790411

Montracon Trailers Ltd
Newtownabbey
Tel: 01232 848274

Noden Truck Centre
Rugby
Tel: 01788 579535

Prolek P.B. Auto Electrics
Mansfield
Tel: 01623 659311

Ring Road Garage Ltd
Buckingham
Tel: 01280 814741

Ripon Auto Electrics
Ripon
Tel: 01765 602253

Scotmech Trucks Ltd
Aberdeen
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Dundee
Tel: 01382 451416

G.Stout Lube Services
Midlothian
Tel: 01968 673247

Tachograph (Chester) Ltd
Ellesmere Port
Tel: 0151 3552101

Tanner Tachograph Ltd
Cardiff
Tel: 01222 225580

Tramec
Bristol
Tel: 01179 822799

Truck Services of Grimsby
Grimsby
Tel: 01472 362929

Frank Tucker (Commercial) Ltd
Exeter
Tel: 01392 833030

Woodwards S V S
St Hellens
Tel: 01744 20266

14.8 PARTS DISTRIBUTORS

ABS Burton Ltd
Burton on Trent Tel: 01283 568037
Aldridge Tel: 01922 455751

All Spares Ltd
Bridgend Tel: 01656 663163
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Llanelli Tel: 01269 831177
Cullompton Tel: 01884 33810
Hereford Tel: 01432 263438

Artic Trailer Ltd
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Falkirk Tel: 01324 613533

Artec Yorks Ltd
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Liversedge Tel: 01924 401689
Hull Tel: 01482 581141
Malton Tel: 01653 698009

Aghabridge Ltd
Kent Tel: 01634 2949

Crane Fruehauf Ltd
For list of branches telephone
Dereham Tel: 01362 69535

Commercial Clutch Services Ltd
Birmingham Tel: 0121 328 4060

Commercial Equipment Ltd
Brierley Hill Tel: 01384 78151

CV Components
Inverness Tel: 01463 220232

CV Spares Ltd
Slough Tel: 01753 680404
Swindon Tel: 01793 5133519

Congleton Motor Factors Ltd
Congleton Tel: 01260 280400
Wirksworth Tel: 01629 823948
Derby Tel: 01332 385901
Stafford Tel: 01785 254634
Buxton Tel: 01298 26588
Chesterfield Tel: 01246 261666
Ashbourn Tel: 01335 346236

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Digraph Trans Supplies Ltd
Awkworth Tel: 01602 322195
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Leicester Tel: 01530 245756

Dingbro Ltd
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Elgin Tel: 01343 552888
Fraserbourgh Tel: 01346 51234
Inverness Tel: 01463 713133
Peterhead Tel: 01779 476551
Kirkalby Tel: 01592 650495
Montrose Tel: 01674 675311
Perth Tel: 01738 443388
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D.M.H. Warrington Ltd
Warrington Tel: 01925 650601
Crewe Tel: 01270 582288
Manchester Tel: 0161 832 4427

E.M.S. Ltd
Northampton Tel: 01604 702552

East Kent Components Ltd
Dover Tel: 01304 204697
Ashford Tel: 01233 631951
Faversham Tel: 01795 537228

Edmunds Walker Ltd
For list of branches telephone
Straford-on-Avon Tel: 01789 414545

Fleet Factors
Middlesbrough Tel: 01642 465141
Stockton Tel: 01642 616333
Carlisle Tel: 01288 810050
Hexham Tel: 01434 600789
Sunderland Tel: 0191 567 1587
Gateshead Tel: 0191 490 0909
Leeds Tel: 0113 277 7400
Stallingborough Tel: 01482 227423
Hull Tel: 01482 227423
Birtley Tel: 0191 410 4437
Manchester Tel: 0161 223 0367
Enfield Tel: 0181 804 3995

Fleetweel plc
Cardiff Tel: 0122 378191
Newport Tel: 01633 841645
Swansea Tel: 01792 775111
Tiverton Tel: 01884 258797
Bristol Tel: 0117 982 6667

Frenco Service Replacements Ltd
Kidderminster Tel: 01562 754931
Banbury Tel: 01295 270711
Oxford Tel: 01865 772161

G.E. Middleton & Co Ltd
Manchester Tel: 0161 872 0923

HGV Truck & Trailer Parts
Boston Tel: 01205 365258

HB Commercials Ltd
Felixstowe Tel: 01394 675675

H & S Commercials Ltd
Wakefield Tel: 01924 279294
Bradford Tel: 01274 721630
Castleford Tel: 01977 603606

Hi-Way Components
Oldham Tel: 0161 652 0315

Hydrair
Blackburn Tel: 01254 889333

L.C. Davis & Sons Ltd
London Tel: 0181 648 7717

LCP Engineering Co Ltd
Gillingham Tel: 01634 575501
Canterbury Tel: 01227 766001
Ashford Tel: 01233 623113
Maidstone Tel: 0101622 672222
Purfleet Tel: 01708 891189
Tunbridge Wells Tel: 01892 535455
Brighton Tel: 01273 430730
Dartford Tel: 01322 557825
Gravesend Tel: 01474 320300

Merlin Components (London) Ltd
Barking Tel: 0181 591 6908

14.8 PARTS DISTRIBUTORS

Multitruck Components Ltd
Milton Keynes Tel: 01908 274400
Welwyn Garden City
Tel: 01707 393000

N.E.T.S. Ltd
Netton-le-Hole Tel: 0191 526 3753
Stockton-on-Tees Tel: 01642 613514
Carlise Tel: 01228 511312
Morecombe Tel: 01524 841057

A.J. Parsons & Sons Ltd
Shepton Mallett Tel: 01749 346161
Redruth Tel: 01209 219764
Launceston Tel: 01566 774341

Partic Motors Spares Ltd
Newark Tel: 01636 702479
Lincoln Tel: 01522 689 409
Nottingham Tel: 01155 976 0977

Peter Bassett
Buckingham Tel: 01280 817174

Port Brake Services Ltd
Ellesmere Port Tel: 0151 355 0226
Liverpool Tel: 0151 525 1558
Widnes Tel: 0151 495 1751
Stoke-om-Trent Tel: 01782 586667
Deeside Tel: 01244 541214
Winsford Tel: 01606 552550
Preston Tel: 01772 696668

Southern Comp. Grp Ltd
Dartford Tel: 01322 553330
Sittingbourne Tel: 01795 420087

Southern Trailer Parts Ltd
Reading Tel: 01118 932 3577

Transport Supplies (NI) Ltd
Belfast Tel: 01232 781230
Craigaven Tel: 01762 362 555

Truck and Trailer Specialists Ltd
Eastleigh Tel: 01703 644746

Truckline
Bristol Tel: 0117 982 1321
Eastleigh Tel: 01703 617666
Manchester Tel: 0161 8725 457
Grays Tel: 01375 394949
Stockton Tel: 01642 607811
Doncaster Tel: 01977 671206

Woodheads / Partco Ltd
For list of branches telephone
Birmingham Tel: 0121 717 0071

14.9 HALDEX - INTERNATIONAL OFFICES

AUSTRIA
Graubremse Wien GesmbH
Tel: INT + 43 1865 16 40
Fax: INT + 43 1865 16 4027

BELGIUM
Haldex NV
Tel: INT + 32 2725 3707
Fax: INT + 32 2752 4099

BRAZIL
Haldex do Brasil Ind. e Com. Ltda
Tel: INT + 55 11 531 4159
Fax: INT + 55 11 531 9515

CHINA
Haldex International Trading (Shanghai) Co. Ltd.
Tel: INT + 86 21 6289 4469
Fax: INT + 86 21 6279 0554

FRANCE
Haldex Europe S.A.
Tel: INT + 333 88 68 22 00
Fax: INT +333 88 68 22 09

GERMANY
Haldex Brake Products GmbH
Tel: INT + 49 177 934 91 70
Fax: INT + 49 711 934 91 740

GREAT BRITAIN
Haldex Ltd.
Tel: INT + 44 1 325 310 110
Fax: INT + 44 7 325 311 834

POLAND
Haldex Sp Zo.o.
Tel: INT + 48 438 43 4614/4516
Fax: INT + 48 438 433 689

SOUTH KOREA
Haldex Korea Ltd.
Tel: INT + 82 2 749 3650
Fax: INT + 82 2 749 3652

SPAIN
Midland Grau S/A
Tel: INT + 34 9 3573 1030
Fax: INT + 34 9 3573 0728

SWEDEN
Haldex Brake Products AB
Tel: INT + 46 418 57700
Fax: INT + 46 418 24435

USA
Haldex Midland Corp.
Tel: INT + 1 816 891 2470
Fax: INT + 1 816 891 9447

15.0 ADDITIONAL INFORMATION

15.1 In the interests of product improvement and development Haldex Brake Products Ltd reserve the right to make product and publication changes without prior notification to the customer.

15.2 Changes that are introduced may affect the way in which components are maintained, serviced, or repaired.

15.3 Haldex Brake Products Ltd operate a bulletin service to ensure that operators of Haldex Brake Products equipment are informed of such changes whenever necessary.
In this respect this section of the manual should be used to file relevant product information.

15.4 MODULAR ABS has several associated products which are mentioned in the service manual. Each product has its own literature in which upgrades are issued with the improvement of the product. This section of the manual should be used to file relevant product information to complement this service manual.

To receive the services of section 15.3 and 15.4 please fill in the form at the front of this manual if you have not already done so and forward it to the address indicated.

15.5 Additional copies of this or other SERVICE MANUALS are available at a nominal cost direct from Haldex Brake Products Ltd at the address given below.

15.6 Questions concerning product or product information should be directed to Haldex Brake Products Ltd Technical Service Department who will be pleased to assist you with your enquiries and who may be contacted by writing to:

Haldex Brake Products Ltd,
Technical Service Dept.,
Moons Moat Drive,
Moon Moat North,
Redditch,
Worcestershire,
B98 9HA

or by

Telephone INT +44 1527 499 600
Fax INT +44 1527 499 576